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IN THE

United States Court of Appeals

For the Third Circuit

No. 12—145 October Term, 1957

RICHARD A. FISCH and ANCHOR PLASTICS CO., INC.,
Plaintiffs-Appellants,
vs.
WILLIAM GOULD, doing business as STAY-RITE SUPPLY CO., and KEYSTONE PLASTICS INC.,
Defendants-Appellees.

Civil Action No. 285—51

On Appeal from Judgment of the United States District Court for the District of New Jersey

APPENDIX TO BRIEF FOR PLAINTIFFS-APPELLANTS

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APPENDIX

Docket Entries

Civil 285—51

Date	*Filings—Proceedings*
3-26-51	Complaint, filed 3-21-51 Summons issued Notice of Allocation, filed (Newark)
4-13-51	Summons returned served on 4-10-51, filed
7- 2-51	Stipulations extending time to answer, filed. Answer and Counterclaim filed.
7-18-51	Reply filed 7-17-51.
4-21-52	Order of re-assignment, filed 4-18-52 (Forman) Notice mailed.
5- 8-52	At call for pre-trial conference, ordered off. (Modarelli) (5-7-52)
5- 9-52	Consent order for substitution of Attorney, filed. (Modarelli) Notice mailed.
5-27-52	Consent order adjourning pre-trial conference to next pre-trial calendar, filed (Modarelli) Notice mailed.
9-11-52	At the call for pre-trial conference, ordered on trial calendar after deposition is filed. (9-10-52) (Modarelli)
10- 3-52	Notice of taking depositions of William Gould in advance of trial, filed 10-2-52
10-16-52	Notice to take deposition in advance of trial, filed 10-15-52.

Docket Entries

Date	*Filings—Proceedings*
10-22-52	Letter adjourning date for taking of depositions, filed 10-21-52
9-11-53	Ordered Pre-Trial Conference off to Next Pre-Trial Calendar. (Modarelli) (9-10-53)
12- 4-53	Pre-trial conference. Ordered placed on the next trial calendar. (Modarelli) (12-3-53)
1-14-54	Transcript of Pre-Trial Conference filed 1-13-54.
4-28-54	Stipulation and order amending complaint, filed 4-27-54 (Modarelli) Notice mailed.
4-19-55	Deposition of Peter H. Seckel, filed 4-18-55. Trial without Jury before Hon. Alfred E. Modarelli; (4-18-55) Trial adjourned to 4-19-55.
4-20-55	Trial continued: (4-19-55) Trial adjourned to 4-20-55.
4-21-55	Trial continued: (4-20-55) Trial adjourned to 4-21-55.
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4-25-55	Trial continued. (4-22-55) Trial adjourned to 5-10-55.
5-17-55	Trial without Jury continued. (5-16-55) Trial adjourned to 5-17-55.
5-19-55	Deposition of William Gould, filed 5-18-55. Trial continued. (5-17-55) Trial adjourned without date.

Docket Entries

Date	*Filings—Proceedings*
6- 6-55	Trial continued: (6-3-55) Decision Reserved.
12-15-55	Transcript of Testimony, filed 12-13-55 (2 Vols.)
5-15-56	Opinion filed 5-14-56 (Modarelli) (Patent invalid)
11-15-56	Judgment declaring patent invalid; dismissing complaint; etc., with costs in favor of William Gould, doing business as Stay-Rite Supply Co. and Keystone Plastics Inc., and against Richard A. Fisch and Anchor Plastics Co., Inc., filed 11-13-56. (Modarelli) Notice mailed.
12-18-56	Notice of Appeal filed 12-12-56. Copies mailed to Smith, Slingerland, Trauth & Holtz, Esqs., and to Clerk, U. S. C. A. on 12-17-56.
1- 8-57	$250.00 deposited in registry in lieu of Appeal Bond. Clerk's Certificate of Cash Deposit, filed.

Excerpts of Testimony

• • •

Newark, N. J.,
April 18, et seq., 1955.

Before The Honorable ALFRED E. MODARELLI, U. S. D. J.

Appearances:

OTTO COOPER, Attorney for the plaintiffs,

ORVILLE GREENE (N. Y. Bar), of Counsel.

SMITH, SLINGERLAND, TRAUTH & HOLTZ,
Attorneys for the defendants,

By DAVID TRAUTH; and

CHURCHILL, RICH, WEYMOUTH & ENGEL,

By HOWARD D. CHURCHILL (N. Y. Bar), and
ROBERT FREEMAN (N. Y. Bar), of Counsel.

• • •

(2) The Court: All appearances noted?

Mr. Trauth: Mr. David Trauth of Smith, Slingerland, Trauth & Holtz. We represent the defendant here as resident attorneys.

The Court: I want the plaintiffs' lawyers first. Who is going to try it for the plaintiff?

Mr. Greene: Orville Greene, 90 East 40th Street, New York, trial counsel for the plaintiffs. Resident counsel is Otto Cooper.

The Court: Now for the defendants, please.

Mr. Churchill: Howard J. Churchill of Churchill, Rich, Weymouth & Engel, 165 Broadway, New

York City, trial counsel, assisted by Robert Freeman, of my office.

• • •

(4) Mr. Churchill: Yes, your Honor. There are only seven claims and I understand now from plaintiffs' memorandum that only five claims are relied upon.

The Court: I see. Then suppose we stipulate. You know what the Circuit Court of Appeals held in my case. They agreed with me in the Newburgh Moire case that if you are going to rely on some of the claims it will have to be done by stipulation. Which claims do you intend to rely on, sir?

Mr. Greene: I think we can narrow it down to two claims, claims 2 and 7 one article claimed, one method claimed.

The Court: Very good. Claims 2 and 7.

Mr. Greene: The reason for that, your Honor, is that there isn't any dispute as to what the defendant is doing, or what he is using. Since these two claims cover that, and the other claims are broader, we say these two claims will try the issue.

• • •

(27) The Court: Mr. Churchill.

Mr. Churchill: There is no contest, your Honor. We have produced a strip which comes under the article claimed and we have practiced the process as set forth in the process claimed.

Mr. Greene: So the defendant will go to the issue of validity, which is the issue we have all been talking about, and which is the issue in contest here, and we won't apply the claims or discuss infringement.

May I call Mr. Franklin Dick as the first witness?

Franklin Dick, for Plaintiff—Direct

(28) FRANKLIN DICK, called and sworn for the plaintiff, testified as follows:

The Clerk: May we have your full name and address?

The Witness: Franklin Dick, D-i-c-k, No. 4 Stuyvesant Oval, New York 9, New York.

• • •

Direct examination by Mr. Greene:

Q. Mr. Dick, you have given your name and address. What is your occupation? A. I am a salesman for Anchor Plastics.

Q. When did you first join Anchor Plastics? A. A little over eight years ago.

Q. Approximately what date was that? A. I believe that was around November—the end of '46; November, '46; November or December.

Q. What was the nature of your first employment with Anchor Plastics? A. I was a salesman looking for business, new items to sell, new customers.

Q. What did you sell? A. We sold polyethylene, a great deal of various types of acetate, butyrate extrusions as well, some Lucite.

Q. When you say you sold polyethylene, cellulose acetate (29) and cellulose acetate butyrate, you mean that you sold finished products made by extruding those materials? A. That's right.

Q. Do you mean that you made products that combined those materials? A. No, sir. No, they were each separate in their own right.

Q. And products were made from one or the other? A. That's right, sir.

Q. What do you know about plastic boning material? A. Plastic boning material was made since my early days

at Anchor Plastics: Within a few months after I was there we made acetate boning, beginning in '47.

• • •

(31) *By Mr. Greene:*

Q. All right. At the time that you joined Anchor Plastics, and immediately thereafter, were you selling, or engaged in the sale of a plastic boning material? A. Yes, sir.

Q. What was that material made of? A. That was acetate, sir.

Q. How was that acetate boning strip manufactured? A. We duplicated the dimensional size of Warren Featherbone.

Q. Will you give approximately the dimensions or size of that since that is not a standard reference? A. Well, the most popular size at that time was in thousandths of an inch, .200 x .050, which is equivalent to a five millimeter Warren Featherbone.

Q. So do I understand that it was a strip that was two thousandths thick? A. Two hundred thousandths wide, fifty thousandths thick.

Q. When you say thick, what dimension do you mean? A. Well, if you lay it down flat you only have about fifty
(32) thousandths thick, and a fifth of an inch, or two hundred thousandths, wide.

Q. Two hundred thousandths wide? A. That's right, sir, or, say, a fifth of an inch.

Q. Oh, I am confused. You mean two hundred thousandths? A. Correct, sir.

Q. Yes. Who was that strip sold to? A. Our first customer for that was the firm of Reuben Honig.

Q. And what did they do with the material? A. Well, they jacketed the material. That is, they put fabric around it with a two-needle sewing machine operation, put that

up into flat coils containing 12 yards each, and sold that to the dress jobbers at so much per gross yards.

• • •

(33) Q. What is the basis of such knowledge as you have of the operations of your customers, such as Honig? A. At that time a man by the name of Tom Bader was the sales-manager for Honig. He came up to see us when we were in Canal Street and gave us the problem. They were distributors of Warren Featherbone and they couldn't begin to get enough. They wanted something else which would do the job and preferably be cheaper. They explained how they work and what they do. I also visited that plant and saw the operation that they had in mind.

Q. What was the operation they had in mind? A. Well, they had observed the way Warren Featherbone was jacketed and they were prepared to set up an operation to do that same jacketing themselves, if we could supply the material suitable for it in continuous coils, which we did.

The Court: So it is from actual observation and knowledge of it. Proceed.

Mr. Greene: • • • (34) I wonder if the Clerk would mark the patent in suit as Exhibit 1, which was, in effect, done at our pretrial conference, and it is so indicated.

The Clerk: P-1, P. H. Seckel patent No. 2,531,234, marked in evidence.

(Received and marked Exhibit P-1.)

Mr. Greene: Now, Exhibit 2 is the plaintiffs' product.

The Court: Bonar will be P-2, your product, is that right?

Mr. Greene: Yes, that is my understanding. I am trying to get the notes of the pretrial confer-

ence. On page 21 of the pretrial conference record plaintiffs' product was marked as P-2.

P-2 is a jacketed strip of plaintiffs' product, namely, a strip of a two-phased material, consisting of cellulose acetate and cellulose acetate butyrate.

The Clerk: Marked P-2 in evidence.

Mr. Greene: It is sold under the trade-mark Bonar, by which it is most readily identified.

(Received and marked Exhibit P-2.)

(35) Mr. Greene: P-3 is an advertisement of the defendant on page 136 of Corset & Underwear Review for March, 1951.

The Clerk: Advertisement will be marked P-3.

(Received and marked Exhibit P-3.)

Mr. Greene: I am going to offer this in evidence since it is your advertisement.

The Court: No objection, it may be marked.

Mr. Greene: As Exhibit 4 I offer in evidence a sample of the defendants' product, which I received from the defendant.

The Clerk: Marked P-4 in evidence.

(Received and marked Exhibit P-4.)

Mr. Greene: And which, as far as I know, consists of an extruded strip, consisting of a two-phased system, cellulose acetate and cellulose acetate butyrate, which is also sold jacketed—or unjacketed, either way—and which is the infringing item.

Mr. Churchill: No objection, except I don't know what the word "jacketed" means.

The Court: I suppose it means a covering of some kind.

Mr. Greene: Just that. That is how it is sold, actually. That's Exhibit P-4.

Now, P-5 will be offered for identification, a strip of cellulose acetate with some needle holes in it, at spaced intervals.

The Clerk: P-5 for identification, strip of cellulose (36) acetate.

(Marked Exhibit P-5 for identification.)

Mr. Greene: P-6 is a strip of Bonar material, with similar needle holes in it, at spaced intervals.

Is there any objection if I call it Bonar?

The Court: I have none. I don't suppose Mr. Churchill has.

Mr. Churchill: I have none.

The Court: As long as we all know what you are talking about.

Mr. Greene: It is one word instead of six.

The Clerk: P-6 for identification, strip of Bonar.

(Marked Exhibit P-6 for identification.)

Mr. Greene: May I also mark in evidence those boards that I gave you.

As P-7 I am going to offer this card, which merely is a generally description picture and sample story of what the plaintiff says occurred in the history of boning.

• • •

(37) The Court: You will have to mark it for identification.

Mr. Greene: Mark it for identification.

The Clerk: Marked P-7 for identification.

(Marked P-7 for identification.)

Mr. Greene: I ask that this card be marked P-8 for identification, which is a chart showing the de-

velopment of Bonar, and listing and exampling the experimental work of the plaintiff.

The Clerk: P-8 for identification.

(Marked P-8 for identification.)

Mr. Greene: And as the final chart a cardboard containing samples of acetate and Bonar strips with certain comparisons of sewing exampled thereon, for identification.

The Clerk: It will be marked P-9 for identification.

(Marked Exhibit P-9 for identification.)

• • •

By Mr. Greene:

Q. Mr. Dick, let me first hand you Exhibits P-5 for identification and P-6 for identification, and state what (38) they are, if you will. A. P-5 seems to be an alabaster acetate boning. Your P-6 is apparently Bonar.

Q. Can you tell if it is Bonar? A. Yes, by bending it. Yes, it is Bonar, definitely.

Q. Is that the product that you have been selling? A. Yes, sir.

Q. For how long? A. Bonar, since February of '49.

Q. Can you positively state, of your own knowledge and experience, that this product, which is P-6 for identification, is the same as the other products sold by you under the trade-mark Bonar since that date? A. Yes, sir: it is.

Q. When you refer to this as alabaster acetate, do you mean cellulose acetate? A. That's right, sir. The alabaster is the color. It is a milky, translucent color.

Q. Now, how is the Bonar and acetate usually sold in the trade, in what form? A. Well, in the dress trade they

are usually sold in coils, sold by the pound, if that is the question.

Q. Are they sold as they are now, forgetting the holes in them, or in some other form? (39) A. We sell them as they are now, in coils, mostly, or in straight lengths, as specified, unjacketed.

Q. Who jackets them? A. In the dress trade the jacketing is done by a distributor. In our case it would be a person such as Honig or Mercury.

Q. How do they jacket them? A. This is done by a two-needle sewing machine, feeding two pieces of fabric through folders, and simultaneously sewing it down along the sides.

Q. Is the Plaintiff's Exhibit 2 a sample of a jacketed piece of Bonar? A. Yes, it is jacketed. Yes, this is jacketed Bonar.

The Court: So you don't do the jacketing?
The Witness: No, sir.

By Mr. Greene:

Q. Do you do the jacketing? A. No, we don't.

Q. Ever? A. No, never have.

Q. Have you had any experience with other than the distributor of the product, with the person who employs the product, Bonar? A. Yes, sir.

Q. To what extent? A. We originally sold this directly to consumers, such as (40) brassiere manufacturers. We still keep a few traditional brassiere manufacturer customers. We have never sold dress manufacturers directly.

Q. You mean then that the brassiere manufacturer buys this product directly from you? A. That's right, sir.

Q. What does he do with it? A. He may either cut it himself or, in the present case, we have facilities for

cutting it to length with rounded ends to his specification. It is then sold by the gross pieces, cut to specification lengths.

Q. Does he jacket it? A. Yes, sir. His jacketing operation is different, inasmuch as the jacket—

Q. A little slower, please. A. A jacket is sewn on to the garment. In most cases the cut bone is then pushed into the pocket or jacket in the garment before the final finishing operation of sewing on top and bottom binding.

Q. I hand you an object and ask you to identify it. A. This is a display piece made for me by Loveable Brassiere a few years back. It was used, I believe, at the Philadelphia Plastic show. Black boning was put into it at my request, so that it would stand up. Otherwise, it is a standard pattern from their production line. It (41) was made smaller than normal to fit the form.

Mr. Greene: I offer this as Exhibit 10 for identification.

The Clerk: Mark P-10 for identification.

(Marked Exhibit P-10 for identification.)

Mr. Greene: P-10 for identification is a brassiere mounted on a plastic form with the Loveable trade-mark, in the form of a heart sticker affixed to the upper central portion of the forward part of the plastic form.

Q. Do I understand that this brassiere was manufactured by the Loveable Brassiere Company? A. Yes, sir.

Q. They also made or obtained the stand or form on which it is mounted? A. Yes, sir.

Q. The brassiere is the regular stock brassiere, excepting for the fact that the stays in it are black; is that what you said? A. Yes, sir. It is stock in this sense, that that was one of their standard display units. Those display units are not standard brassiers. They are too small to

be a standard size. But they made up quite a few of them for display purposes.

Q. When did you receive this, as close as you recall, Exhibit 10 for identification? A. I believe that was in '48, because we had that for the (42) Philadelphia Plastic Show in '48.

Q. Was it sent directly to you, care of Anchor Plastics Company, or some other way? A. No, I picked it up there. It was made and I went up to their office and got it.

Q. Where is their office? A. At 180 Madison Avenue.

Q. Was that about the date you mentioned? A. I am not sure whether they were there at that time, or at 585—555 Fifth Avenue.

Q. Was it at one of those two places? A. One of those two places.

Q. Has it been in your possession, or in your custody, ever since? A. Yes, sir.

Mr. Greene: I will offer it into evidence as Plaintiff's Exhibit 10.

• • •

(43) *By Mr. Greene:*

Q. How are the stiffening stays in Exhibit 10 for identification used in the brassiere; what is the operation of their use in that brassiere? A. Well, they actually give support and keep the garment up, of course. They are put in to this sewn pocket—

Q. You will have to identify it more exactly. This is for the record. Please bear that in mind. A. The operator who manufactures these brassieres has a bunch of them on hand and she pushes them into the pocket before—

Q. Pushes what into the pocket? A. The bone, into the pocket before the last operator sews top and bottom together.

Q. When you say "pocket", what are you referring to? A. There is a fabric sleeve made by the sewing lines, into which each of these Bonar stays just fits.

Q. And who inserts that Bonar stay? A. On the production line there is a girl who is known as a stuffer, and she puts them in. She passes it down the line to the next operator, an operator who operates a machine, and finishes it.

Q. What do you mean by finishing it? (44) A. She does the last operation, the sewing, the top and bottom binding, which completes the assembly of the garment.

Q. Is the binding a separate strip superimposed upon the brassiere or is it a folded over strip or just a line of stitching? A. In this case, it is both. It is a separate strip combined with a folding over operation.

Q. Are you referring to the bottom or the top of the brassiere? A. That's referring to the bottom. On the top itself we have a separate strip of ruffling, which acts as the binding, plus the body of the fabric, which is also folded down upon itself.

Q. Will you state and repeat in part how the plastic stay, Bonar, is maintained in the position it is shown to be in here? A. There is anchorage both at top and bottom, because the sewing lines cross the bone. The bones go right up to the top and bottom.

Q. Do you mean that the sewing line crosses over or goes through? A. Cross over and goes right through. There is no skip stitching there.

Q. Does that mean that the needle has passed through the bone in that area and the thread has passed through and (45) secured the boning? A. Yes, that is the strong point of the material. It goes right through without hurting the thread or the needle. You may have four or five stitches through each bone, top and bottom.

Q. That occurs at the top and bottom? A. That's right.

Q. The anchoring by means of the sewing through the plastic strip, Bonar? A. Correct.

Mr. Greene: I submit it is relevant.

The Court: I believe it is. It may be marked.

The Clerk: P-10 formerly marked for identification, now marked in evidence.

(Received and marked Exhibit P-10.)

Q. Have you ever had the direct experience or observation of a sewing through operation in which materials other than Bonar were employed? A. Yes, sir. In the early days of our development we had a sample from the Gossard Company in Chicago, who are major manufacturers of ladies' garments. At that time featherboning was very short and they had taken plain acetate, cellulose acetate, and in order to make it sewable they had double stitched it. They had a girl sew it with a needle that had no thread in it, in a regular machine, hand feeding it and (46) twisting the wheel to push the needle down slowly. That was then resewed with a threaded needle in order to make an anchorage. That was done as a product of desperation.

Mr. Churchill: I object to the characterization.

The Court: Don't characterize it.

Q. I wonder if I have it clear. Let me repeat it. I am not sure that I do. Was this stay, acetate stay, in a garment? A. Yes, sir.

Q. What type of garment? A. That was in a brassiere, sir.

Q. Generally, as these stays are located in Plaintiffs' Exhibit 10? A. That's right.

Q. And those stays were made of cellulose acetate? A. That's right, sir.

Q. And they were stitched over by a needle without a thread first? A. That's right.

Q. And then followed over, when the holes were made, with the needle with the thread? A. That's right, sir. I might add, to finish that question, that was very limited production, because it was not satisfactory. Those bones broke at the sewing point, top and bottom, and made a mess.

(47) The Court: Did you see that yourself?

The Witness: Yes, sir. It was done by the sample maker in the New York office.

Q. The New York office of whom? A. Of the Gossard Company at 200 Madison Avenue.

Q. Do you remember the sample maker's name? A. No, sir; I don't.

Q. Do you remember about what date it was? A. Generally speaking, I would say that was in either '48 or '49.

Q. Why did it break? A. Well, they had perforated acetate and like—well, this alabaster acetate sample here. If you bend it—

Q. Referring to Plaintiffs' Exhibit 5. A. There are perforations here. If I bend them sharply, any one of them will break off.

Q. So was that experiment of double stitching unsatisfactory or satisfactory? A. It was unsatisfactory, sir.

Q. Was it continued or discontinued? A. It was discontinued.

Q. Do you have your own positive knowledge of that, of what Gossard did later? A. Yes, sir. They later on still kept looking for materials until designs changed and they went to wire forms rather than (48) using boning, as such.

Q. I am going to revert now to your knowledge of the boning art in your early days with Anchor Plastics. Did you have a knowledge of what was going on in the sale and use of this boning material at that time, in 1947? A. Yes, sir; I was just learning about it, but I had a fairly good working knowledge of it.

Q. How did you have a working knowledge? A. By visiting our customers who would show me what the problems were.

Q. You are now talking about your activities during your time with Anchor Plastics, the company plaintiff? A. Yes, sir.

Q. And what was the boning material, or boning materials, that were being used then? A. At that time they were steels, Featherbone, spiral boning and plain acetate.

Q. I hand you Plaintiffs' Exhibit P-7 for identification and refer you to the portion there which says, "Steel stays." Will you comment as to the pertinency of the sample at the right-hand side of that card. A. This is one of the products which was then being used, and is still being used, in the foundation industry. It has its problem due to the fact that the edges, even coated as this, are sharp and they cut through the types of top and (49) bottom binding, particularly the bottom binding where the weight bears down.

Q. Are you referring now to the use—you are indicating the brassiere, which is Plaintiffs' Exhibit 10. Are you referring to the use of a steel stay in a brassiere, such as Exhibit 10? A. Yes, sir.

Q. All right. Say that, if you will, in each case, because the record will not show what you are looking or motioning to. Explain that a little more fully, the use, advantages or disadvantages of steel stays in brassieres or similar garments. A. Well, the steel stays were at that time considered to be a good deal more expensive than the

plastic stays because at that time the machinery had not been as well developed for skip sewing, that is, sewing up to a certain point, letting the threads float a quarter inch, and picking up on the other side of the steel bone. That at that time was a hand operation so that while the steels were relatively cheap, that is, they didn't cost any more—much more than the acetate, I believe, they were in the same general price bracket—the cost installed in the garment, the final price, ran much higher than the sewable type of boning.

Q. Why did it run much higher? A. Because the biggest cost for making a garment is labor. (50) That's piece work and if the operator has to slow up, hand feed the machine to skip a piece of steel, she has to get so much more per piece for that garment.

Q. Do they have to sew in all usages of the steel stay, is there sewing operation involved? A. I believe with the exception of foundation garments, such as corsets, where then they have to separately close the top of the pocket.

Q. How? A. By means of a few stitches with a sewing machine.

Q. You mean the sleeves then are formed before you put the stays in; is that what you are saying? A. Yes, sir.

Q. What happens under wear of a garment and passage of time with respect to steel stays, if anything? A. Well, steel stays, because of the typical sharp corner, the fact that they cannot be anchored down to the garment, tend to poke very bitterly. They are normally in better grade garments plushed to protect the wearer from the garment. The plushing is—even the best plushing will wear out, and the majority of garments, I am told, of foundation garments, have the steels eventually taken out.

Q. What is plushing? A. Covering with a plush, a pile fabric, like a velvet.

(51) Q. Covering what? A. The top and bottom, in some cases the whole length of the bone, with the plush between the bone and the body of the wearer.

Q. Are steel stays now used to any extent in the brassiere or strapless swim suit trade? A. Yes, sir; they are.

Q. Steel stays? A. Yes, sir.

Q. Do they still have the disadvantages that you mentioned? A. Yes, sir.

Q. What is the next item referred to under this card, Plaintiffs' Exhibit 7 for identification, entitled history of boning? A. That's Featherbone, sir.

Q. What is Featherbone? A. Well, Featherbone is a product of the Warren Featherbone Company. Featherbone is their trade name.

Q. Where is that company located? A. In Three Oaks, Michigan.

Q. What does it manufacture? A. Its namesake, Featherbone, is the first product. Currently they make a great many other items, including baby pants, shower curtains and quite a line of notions.

(52) Q. For how long have you known of the manufacture by that company of Featherbone? A. Featherbone goes back before I was born.

Mr. Churchill: I think that is a little bit beyond the recollection of this witness.

The Court: It sure is. Nobody will dispute that.

Q. Would you say it goes back many years before the '40s, your recollection? A. Yes, sir; it does.

Q. What is Featherbone, how is it made, and is that sample that you see affixed on Exhibit 7 a proper and true sample of the product, if you know? A. Yes, I recognize it well. Featherbone, according to literature of the Warren Featherbone Company, which I have read, is made of turkey quill, slit lengthwise, and with the strands bound

together. These strands are then assembled into the widths required. The material is made in various widths and thicknesses. The thicknesses are then braided together and sized. This makes what we now call Featherbone.

Mr. Churchill: That whole answer is hearsay, your Honor.

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(53) The Court: He said what he is now testifying to is not of his own knowledge.

Q. Have you seen Featherbone, samples of Featherbone? A. Yes, sir.

Q. Have you taken them apart? A. Yes, sir.

Q. When you take it apart, what do you see? A. You take apart an outer layer of sizing, which can be taken apart by either rubbing it or washing it. Underneath that is a loose braiding. Inside the braiding are anywhere from six to fifteen cord-like arrangements made up of slit—what appears to be quill bound together, round and round, by cotton.

Q. Did you have to go to their factory to tell those facts, or can you tell them from the examination of the product, Featherbone, if you look at it or take it apart? A. Yes, sir; I have taken it apart many times.

Q. Why are you interested in Featherbone, if you are? A. Featherboning, in certain respects, is a beautiful product. We would like to make something as good or better than (54) Featherbone.

Q. Why? A. Because we can make money making it.

Q. Why is it a good product? A. It is a good product because it is sewable both across and lengthwise. It has a minimum of cold flow, that is, it returns to an upright position once it has been flexed better than many plastic materials will. It holds together very well under sewing at top and bottom binding, it does not tend to open up.

Franklin Dick, for Plaintiff—Direct

Q. Are you interested in the products that compete with the product, Bonar, that you sell? A. Yes, sir.

Q. Are there many such products? A. Primarily Warren Featherbone, sir. The only one of any significance.

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(55) Q. Is the sample that you see here of Featherbone, on line 3 of Exhibit 7, a true sample, according to your experience with Featherbone, or is it not? A. It's a true sample, sir.

Q. Who supplied that sample for this Exhibit 7? A. I did, sir.

Q. Where did you get it? A. I got it from Reuben Honig.

Q. Who is Reuben Honig? A. A distributor and jobber of Warren Featherbone.

Q. What does the next line show on Exhibit 7? A. That's Featherbone after it has been washed.

Q. What happens to it after it is washed? A. It lost a certain amount of its sizing and with that loss of sizing lost a certain amount of stiffness.

Q. What is the condition of it, if you know, during the washing operation? A. Well, its wet strength is relatively poor. It becomes, I might say, a little bit on the tender side and has to be handled carefully when it is thoroughly wet.

Mr. Greene: I offer a tube containing a piece of Featherbone in liquid as Plaintiffs' 11 for identification.

The Clerk: Marked P-11 for identification.

(Marked Exhibit P-11 for identification.)

Q. I hand you Plaintiffs' Exhibit 11 for identification (56) and ask you to state what it is, if you know? A. It looks like Warren Featherbone taking a bath.

Q. Have you seen this before? A. Yes, sir.

Q. What is the condition of the product inside; have you tried it, checked it yourself, previously? A. Yes, sir. It is wet. There is just plain water in there. It typically —well, it's from the same coil of Featherbone as the sample on here.

The Court: On P-7.

A. (Continuing) It doesn't have the spring.

Q. Doesn't have what? A. Doesn't have the spring or strength when it is wet.

Q. When you say "the spring or strength" you mean its original— A. Its original strength.

Q. Does it have enough strength—would it be a supporting means when it is wet? Put it this way: Is this used in swim suits? A. No, sir; by and large, it is definitely not.

Q. Why?

The Court: The action of the water on the Featherbone.

A. The swim suit has to be over-boned to allow for its wet strength.

Q. Did you make up this sample—that's P-11—yourself (57) or did someone else? A. No, I did not make that up.

Mr. Greene: I ask that these two tubes here—one marked "acetate" and one marked "Bonar"—be marked as Exhibits 12 and 13, respectively, acetate 12 and Bonar 13, for identification.

(Marked Exhibits P-12 and P-13 for identification.)

Q. I hand you Exhibits P-12 and P-13 for identification and ask you to state what these are, if you know. A.

Well, this is acetate, I believe, in water. And this one, I can see by the imprint on it, is Bonar in water.

Q. What imprint are you talking about? A. The trademark printed on the surface.

Q. On the surface of what? A. Of the plastic material.

Q. Do you know what the condition is of the acetate and the Bonar strips which are contained in the tubes, Exhibits 12 and 13, respectively? A. Well, there won't be any difference for practical purposes, wet or dry, between either of them.

Q. Wetness does not affect them? A. No, sir.

Q. Acetate or Bonar? A. Very, very slightly, sir.

Q. Is that good or bad, with respect to the problems (58) of the stay industry? A. It is very good.

Q. Did you prepare those samples, Exhibits 12 or 13? A. No, sir.

Q. Who did? A. I believe Peter Seckel did.

The Court: The patentee?

Mr. Greene: The patentee.

Q. Will you look at the next line on Exhibit 7 for identification, labeled "acetate," and state what it is. A. This is alabaster colored cellulose acetate strip used as a boning material.

Q. Is that product known to you? A. Yes, sir.

Q. Did you sell it? A. Yes, sir; I believe we made this a few years back.

Q. What time do you mean? A. Pardon?

Q. About when do you mean when you say a few years back? A. That would go back—we have made very little acetate in the last five years. I suspect it probably is that old.

Q. What was the acetate used for that you sold, that you referred to? A. I believe this was a brassiere job.

Q. You mean brassiere boning? (59) A. Brassiere boning; that's right, sir.

Q. Is that the product you sold when you first came with Anchor or did you sell other types of boning? A. This is pretty much it, except for possibly variations in color to customer specifications.

Q. What were the advantages and disadvantages of acetate that you know of from your own experience and observation? A. Well, acetate had a price advantage over, let's say, Warren Featherbone.

Q. To what extent? A. Well, I will give you a direct comparison which is true today. Warren Featherbone come in the terms of Gossard's, in the cheapest grade, will sell for about $13 a gross yard to the dress manufacturer.

Q. I didn't get that. How much? A. About $13 for 144 yards, a gross yard. These same dress manufacturers can buy acetate boning for about $5 for the same footage. That's the reason for it, for the existence of acetate boning.

Q. It is less than half the price? A. That's right.

Q. All right. How does it compare to Featherboning and other boning? A. It is very largely used by manufacturers who don't particularly care what happens, as long as the dress gets (60) sold, by the cheapest class of dress manufacturers. There is a lot of Featherbone used by better grade dress manufacturers because it has been traditional for so many years. The qualities of acetate boning—the unfortunate quality of it splitting, have acted against any kind of plastic boning, and have been one of my problems in the last few years.

Q. What do you mean by splitting? A. Well, when it is sewn across it will break off. If it is flexed too much, even in a dress or a garment, without even being sewn it will break very readily. It won't hold together.

Q. How does it break? A. If there is a point of flexure it will break after a while with relatively sharp corners

in that break and usually with a twist or bend at the point of break, the bend which caused it to break. The garment will then have a floppy looking section there. The garment will be worthless until the boning is replaced.

Q. Does it have a clean fracture or is it a rough, stringy or other type of break? A. No, sir; it is a clean, sharp fracture.

Q. You are talking about the breaking of acetate? A. Yes, sir.

Q. Was it ever sewn across? A. Never deliberately, sir, no.

(61) Q. Why? A. Well, experience has shown it will break at that point very easily.

Q. Are you saying that nobody made a practice of sewing across acetate, that you know of, or was it just simply unusual? A. It was very unusual. It meant very bad manufacturing practice.

Q. How about the hardness of acetate with respect to its sewability; if you did sew across it by design or accident what, if anything, would happen? A. Well, you wouldn't get very far, production-wise, because if you didn't break your needle you would break your thread with the first stitch. Your operator would have to stop and re-thread, and if she hit it at a good speed she would break the needle in the machine.

Q. Why would you have to re-thread? A. Well, the friction of the hole would pull and break the thread. Even on hand feeding the sewing machine into acetate boning, you won't get through with an intact thread.

Q. You said you would break the needle. Why would this plastic strip break the needle? A. Well, it is hard and horny and offers such resistance that when the needle hits the plastic material going at a good speed it was practically as if you hit a piece of steel. (62) There was no give.

Q. Are there any other reasons why acetate is not a good boning that you haven't discussed? A. No, sir; I believe we have covered it.

Q. The last piece on this list is Bonar. Do you recognize that sample on Exhibit 7 for identification? A. Yes, sir.

Q. How do you know that that is Bonar? A. Well, without taking it up in my hand, we imprint the Bonar trade name on the surface of all the Bonar we make.

Q. By imprint—do you mind if I amend and say "emboss"; is that what you mean; is it embossed in or simply printed on the surface? A. Well, if you want to be technical, it is debossed.

Q. This card, Exhibit 7 for identification, then contains samples of each of the listed products that you, of your own personal knowledge, can testify as to their accuracy; do you know that this is steel, Featherbone, acetate and Bonar? A. Yes, sir.

Q. How much experience in point of years have you had with these products, either selling them or in competition with them? A. Well, since 1946. That's nine years.

Q. Did you find any whale bone? A. No, sir. I have seen it, but not in use.

(63) Mr. Greene: I will offer 7 in evidence.

The Court: Any objection, Mr. Churchill?

Mr. Churchill: I object to its relevancy, your Honor, as having nothing to do with the claims of the patent in suit.

The Court: Well, it may be marked for the purpose of possibly assisting me. You know that is a perfectly good reason in patent cases.

Mr. Greene: Maybe we can save more time. Its relevance to me is that I am comparing the product of the invention with the various other products.

The Court: What are you worrying about? I said it may be marked in evidence.

Mr. Greene: I was saying, can we short-cut further testimony on this by saying—does the defendant concede that the Bonar product is a better boning than acetate and has many advantages over that?

I am inclined to think he might, because our Exhibit 3 here is an advertisement that states these advantages. Now maybe we can save some time on this.

The Clerk: P-7 formerly marked for identification, now marked in evidence.

(Received and marked Exhibit P-7.)

The Court: Maybe Mr. Churchill will.

Mr. Churchill: I am willing to stipulate, your Honor, that the strip material produced by mixing cellulose acetate (64) and cellulose acetate butyrate, which is produced through an extrusion apparatus, is better suited for use as a boning material when the customer wants to sew across that material and take advantage of the fiber construction to let the threads go across it. It is better than cellulose acetate, as such, because cellulose acetate, as such, will not form such longitudinal fibers.

Mr. Greene: Is it conceded that the steel stays cannot be sewn through? There is no contest on that, is there? I just want to compare and dispose of this. Steel stays can't be sewn through, or directly at the edge, with safety, is that correct?

Mr. Churchill: I don't know, your Honor. I know this only, that steel stays are still used extensively in better foundation garments and that

they have definite advantages today over these plastic products.

The Court: For certain dresses.

Mr. Churchill: For certain dresses, certain types of brassieres.

The Court: Don't you think that I can take judicial notice of the fact that you can't sew through a steel stay with a needle?

Mr. Greene: It also goes a little bit closer—you can't go right around the edge for fear of hitting it.

The Court: I can understand that, too, and I don't (65) know anything about sewing. I can see the danger.

Mr. Greene: And the Featherboning on that—again as has been stated here, it is a good boning, but when it is laundered, it softens and gradually disintegrates. And I don't suppose there is any contest on that, is there?

Mr. Churchill: I have no knowledge of Featherboning, so I would be willing to accept the witness' testimony on that.

The Court: It seems so to me.

Mr. Greene: I think so.

The Court: I have no special knowledge, either.

Mr. Greene: And so far as acetate is concerned, I think the testimony is, and it is conceded—and, by the way, in the defendants' advertisement he says—"Stay-Rite boning. Sew through it" is the headline, "flexes and bends, launders well and unbreakable."

And all I am saying is I believe that the defendant can and should concede that you can sew through this boning without damage and that you couldn't sew through cellulose acetate without injuring the needle, or breaking the acetate, and that this Bonar material, which is the product in suit, is far stronger

and relatively unbreakable, and if bent, bends with a fibrous bending as against the sharp fracture that you get—and the quick breaking of cellulose acetate. That is what his advertisement, in effect, says.

The Court: Is that so, Mr. Churchill?

(66) Mr. Churchill: Yes, indeed. We recognized immediately that when you want a product to sew through this mixture of cellulose acetate and butyrate was the product that would do that. And that is what we put it out for.

The Court: Yes, sir.

Mr. Greene: All right.

Q. Now, I would like to ask you, Mr. Dick, what you know with respect to the activities at Anchor Plastics in the experimentation, trying to develop a boning rather than acetate; do you know anything about that? A. Yes, sir.

Q. What do you know about their activities in that respect? A. Well, I have been urging—I think I have been instigating a good deal of the development in that field, because I saw the need, I reported back to Mr. Fisch that there was a substantial market there, the various results were taken out to the field by me, where they warranted it, and given actual tests. In other cases I did actual field work to get compponents or ingredients required for the test.

Q. Why were you going for a different material here other than acetate or cellulose acetate boning, what was the reason for that?

The Court: Well, it is quite obvious from what he said already what the reason is.

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(67) Q. Why then did you want to get a boning other than the cellulose acetate boning which you were selling, as I understand your testimony, for Anchor Plastics in late '46 and '47? A. Well, we wanted to, frankly, get away—get some of the business away from Warren Featherbone, not just the stuff they couldn't supply, but there was substantial business there to be had if we could make a product which would do the same things that Featherbone did and possibly do it better.

Q. Would cellulose acetate do it? A. No, sir; it didn't, but for a while that was the best we had and we tried to improve on that.

Q. All right. Was this a specific problem of your competitive position, or do you know as to the sales activities (68) of your competitors, if you had any in this business? A. I believe at that stage of the game other people very shortly afterwards got into making plain cellulose acetate.

Q. Was Warren Featherbone the biggest manufacturer or only manufacturer of stay material for this trade? A. No, sir; at that time steel boning was used; spiral boning was also used.

Q. What is spiral boning? A. It is a boning made of twisted wire which is capable of not alone bending back and forwards, like this, but side to side as well. It is very good and also very, very expensive, even more than Warren.

Q. What is it made up of? A. I believe it is made up of steel, plated so as to be rust-proof, in flat circular pattern. They are interlocking loops.

Q. What is it, steel strips or steel wire? A. Steel wire.

Mr. Greene: I offer this spiral boning as Plaintiffs' Exhibit 14 for identification.

The Clerk: It will be marked P-14 for identification.

(Marked Exhibit P-14 for identification.)

Franklin Dick, for Plaintiff—Direct

Q. I hand you P-14 for identification and ask you to say what it is. A. This is spiral boning, sir.

Q. And is spiral boning the product you just described (69) in your testimony? A. It is.

Q. Is it a product sold on the market? A. It is.

Q. Have you seen it before? A. Yes, sir; many times, for many years.

Q. Is it competitive to the product, Bonar, that you sell? A. Yes, sir; in a way it is. It is much more expensive and it is used in the best grade garments.

Q. How much more expensive? A. I would say three to four times, sir.

Mr. Greene: I offer P-14 in evidence as an example of spiral boning.

Mr. Churchill: I object to it from the standpoint of its relevancy.

The Court: It may be marked.

The Clerk: P-14, formerly marked for identification, now marked in evidence.

(Received and marked Exhibit P-14.)

Q. Will you proceed? You were describing the product that you were in competition with and that you were trying to be in better competition with, I believe. A. Our main competition at that time was Featherbone and then shortly afterwards we had competition from other extruders (70) who made cellulose acetate the same way we did. It was my purpose to improve our product so as to leave that competition behind, as well as to enlarge our sales potential. We made changes, we tried fluting acetate so as to make it more sewable.

Q. Let's get down to some sequence in dates, if we can. And for that purpose I am going to hand you this card, which is entitled "Development of Bonar." Plain

tiffs' Exhibit 8 for identification, and ask you to describe that card and the contents of it. A. Well, this card shows pretty well the bulk of our developing work which wound up in Bonar. First we have the plain acetate boning, which we have gone over. We made fluted acetate boning, which is simply a patterned material, so that the needle would have less material to penetrate at one time.

We also made the acetate—we experimented, we made the acetate around cotton—I don't see it here, but it is marked. We lost those samples. We tried covering cotton tape and cotton braid, both, with cellulose acetate. That was not successful. We couldn't make them stick together.

Then we veered off into making—covering wire. Here is a sample of polyethylene and wire. This, I believe, is a nickel silver wire, which I secured.

Q. I wish you would give me the approximate times, as (71) close as you can, when these different steps were carried out, if you know them. A. Well, the fluted acetate I believe was in about the middle of 1948, while the acetate around the cotton was in the summer of '48. The polyethylene and wire we got into in the latter part of 1948. The nylon and wire also about the same time.

Q. When is that? A. The latter part of '48. Then following that we went into covering synthetic tapes, tapes made up of acetate rayon and viscous rayon with acetate.

> Mr. Greene: By the way, I don't know if your Honor understands, acetate is a fabric as well as a stiff plastic. And they took a fabric and covered it with plastic.

Q. Where is the sample there? A. We didn't keep any samples of that.

Q. When was it done? A. That was in the beginning of '49, January or February.

Q. Go ahead. A. We couldn't make that stick and bond together. Right after that we had an idea and we did the same thing but using nylon with the tape. That, again, we had production trouble with. We got samples of that, but we never put it into production.

The Court: Was that '49, too?

(72) The Witness: Yes, sir.

Q. What part of '49? A. That was the beginning of '49, sir, the very early part of it.

Q. What's that? A. The very early part of '49.

Q. What do you mean; January, February, March? A. I believe that was in January.

Q. Have you finished that list? A. No, sir. Right following that, again in the beginning of '49, I believe, the following month, we made our first Bonar samples. And that met initial resistance, but it very soon picked up and became a very good commercial item.

Q. All right. With which of these various experiments did you have actual contact, participation, observation—define the extent to which you actually know about or conducted any of these experiments? A. Well, I go back to the original one, the plain acetate. That wasn't an experiment, we just made it.

On the fluted acetate, I don't recall who advanced the theory of it, but I know I was in there with that thing.

Q. What was the theory of it? A. That if we sewed through a thinner section we might prevent the needle and the thread from breaking, at least accomplish that much good. It did that, and this item (73) is still in commercial production, not by us, but by other people.

Q. Why isn't it in production by you? A. We have a better product.

Q. Did Anchor Plastics itself make a fluted cellulose acetate? A. Yes, sir; we did.

Q. How did you make it? A. We made the correct type of extrusion die and ran it out.

Q. Who made the die? A. I don't know. That is Mr. Rothman's department.

Q. Who is Mr. Rothman? A. He is our production chief.

Q. Did you ever see a piece of fluted material such as is sampled there in Exhibit 8? A. Yes, certainly.

Q. Did you ever see it made? A. I think I have; yes, sir.

Q. Where did you see it made, if you do remember? A. I believe that would be on the fifth floor in our plant on Canal Street.

Q. Did you ever sell any fluted acetate yourself? A. Oh, yes.

Q. What were its disadvantages? A. It broke, when it was sewed. It also broke very readily (74) upon bending.

Q. How about acetate around cotton, what was your participation, if any, in that experiment? A. Well, that was an idea—again I don't recall whether it was Mr. Fisch's idea, Mr. Rothman's or mine, but I went out and I got the various samples of cotton tape. The first tapes we had were woven, later we went to braided tapes. I went out and obtained both those samples, which we tried running through on our machine. We could not get a bonding action, in spite of extensive experiments, of heating the tape to dry it, of actually putting vacuums on the back end of the machine to get the air out.

Q. When you say bonding action, what do you mean? A. We wanted to get a homogeneous bone where you could not separate the cotton tape from the covering.

Q. Where was the cotton tape located? A. In the center. It was covered all around by the cellulose acetate.

Q. Do I understand then that you say that the bond of the cellulose acetate enclosing the tape was not sufficient? A. No, sir.

Q. What happened? A. You could take an end of the cotton tape and zip it out, pull it right out.

Q. Did you try to remedy that lack of bond? (75) A. Yes, sir.

Q. How? A. Well, I can't speak of my own knowledge. Mr. Rothman did a good deal of work on that with me sticking needles into him.

Q. You didn't do it yourself? A. No, sir.

Q. The next sample I see is polyethylene and wire. What is your participation in that, if any, and when did it occur? A. We had a theory there that since the polyethylene was very readily sewable, possibly the needle would glance off the wire and go through. I investigated wire and I got those samples of wire and others as well, trying to get as high tensile wire as we could that was rustproof, which we could use in there. We got our best results with nickel silver wire, which came from a place in Seymour, Connecticut. But when this boning was bent, repetitively, the wire tended to creep forward, and it would poke out of a cut and scratch.

Q. When you say creep forward, what do you mean? A. The wire would move.

Q. With respect to? A. With respect to the polyethylene.

Q. What would be the effect of that? A. Well, it would scratch very badly, because the sharp end (76) of the wire would stick out possibly a sixteenth of an inch, in some cases even more. That was enough to poke through fabric binding.

Q. The problem then was one of the bond between the wire and the polyethylene, I gather; is that what you are saying, if the wire poked out? A. Well, it didn't poke out

when you first cut it. It was a snug fit. But since there was no true bond between the two, there was just a friction fit. As you bent it back and forth, since you had three wires in there, one would flex more than the other and the wires just tended to move.

Q. Was it a satisfactory product? A. No, sir; because the creepage of the wire was unsatisfactory; otherwise it sewed well and it was satisfactory.

Q. About the acetate around cotton, why did you try that combination, and how was the product itself, if you did make or observe any tests on the product itself, with respect to its use as a boning? A. We figured that if we had a soft center there would be a space for the material displaced by the needle to go, and it would be sewable, because if you will sew into a piece of wire and Feather-bone you will find that in cross section there is a harder crust, top and bottom, and a relatively porous interior section. We thought the same thing—something of the same thought might be valid by using a (77) cotton tape and a hard acetate jacketing.

Q. Was it a good sewable material? A. I believe it sewed very well, but it wasn't a commercially practical material, because it would delaminate and you could take the cotton out of it. And it was just not acceptable commercially for that reason.

Q. What was the next experiment?

* * *

A. That was the acetate and the rayon tapes.

(78) Q. Were they satisfactory? A. No, sir; they were not.

Q. Were they sewable? A. I don't actually know whether they were sewable or not, because we never got that far. When we saw the tape would not stay put we didn't test any further.

Q. All right. What is the next, and next to the last, experiment listed on this page? A. Right after that, while we were working on those tapes, we tried nylon, and the nylon tape was better, although we never went into commercial production of it, because it turned out to be very tricky to make. We made some samples which were well received, but we couldn't uniformly duplicate them, and we didn't want to get into something which was that difficult to manufacture.

Q. About when was that? A. That was, I believe, in February of '49.

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(80) *By Mr. Greene:*

Q. Well, on that, how many experiments were carried out, how many do you have in front of you? A. We list—I believe I have seven of them here.

Q. Did you have variations of those that you don't have samples of? A. Oh, yes. These are the major breakdowns. I will give you an example. We speak of acetate and other tapes here. Well, we first tried acetate around cotton, and it was no go. I read of the use of non-woven fabrics, which are bonded plastics, heat sealed. I thought there might be a clue there, and I got some acetate tape in the hope that perhaps the acetate would bond to the extruded acetate. It didn't work. We tried a mixture of plain acetate, acetate rayon, (81) and viscous rayon and acetate rayon before we gave that up as being unsuccessful. But here we just say acetate and other tapes for the sake of simplicity.

Q. When did these experiments take place? A. That was the beginning of '49.

Q. When did they first begin, all of the experiments, I am not talking about the last one. A. Well, all of them,

I believe it was a full year or more before that of experimentation.

Q. Were they done at once, or conjointly, or one right after the other? A. There were intervals between them. We had many things to do besides experiment. But we were at it pretty steadily, trying one thing after the other, during that year, or more than a year.

Q. That was in 1948? A. That's right.

Q. Could you, without refreshing your recollection, or using notes, give the details of these experiments that we have just discussed? A. Well, not as far as the production goes. That is not my concern. But as far as what we did, yes, in general point.

Q. All right. I hand you a sheet of paper and ask you if you can identify that. Wait. Let me see, have we—let's put this in. I ask you if you can identify that. (82) A. Yes, sir.

Q. What is it? A. It is a confirmation—copy of a confirmation sent to Reuben Honig on November 30, 1948 for some development work they wanted us to do for them.

Mr. Greene: I ask that this confirmation copy be marked as Plaintiffs' Exhibit 15 for identification.

The Clerk: It will be marked P-15 for identification.

(Marked Exhibit P-15 for identification.)

Q. Now, will you tell us what it is that that paper represents, that P-15 for identification? You told us it was a confirmation copy. A. That was one of our first efforts to improve acetate by means of putting a braided cotton core inside the extruded cellulose acetate. We tried —we specifically set up to try three different formulas of acetate there as noted in my writings here at that time.

Q. Who drew up this confirmation order? A. I believe I did, sir.

Q. Where did the original go? A. It was mailed to Honig.

Q. Do you have the original? A. No, sir; I don't.

Q. Did you try to get the original?

Mr. Churchill: I have no objection to a confirmation (83) copy being used, your Honor. I hope we will be extended the same privilege.

Mr. Greene: All right. I am going to offer it in evidence, just that you can look at it, your Honor.

(Document handed to the Court.)

Q. Tell me what it is, in effect—I know what it is about—is that a demand for money, a notation? Tell me what it is. A. It is an agreement that they would pay us $180 as a share of our development work towards making a cored extrusion, this cotton inside of acetate, which we were to do experimentally.

Q. Why were they going to pay you that? A. They wanted to get a better boning than the acetate, which we then supplied.

Q. At whose instigation did this particular experiment come about, yours, or theirs, or someone else's? A. I'd say that was jointly. So we were interested beyond their own demand, because they covered the dress trade, but we had other interests in the foundation trade, as well, which had the same needs.

Q. Was this a lonely representation of the desire for a better product, or is there other such representations that you can think of? A. No, sir; I believe they were primarily interested in paying us for it, so that they would tie us up, and we would (84) not be able to probably offer it wholesale to the trade who all wanted it, because

once we accepted their money we would be obligated to them.

Q. Did you accept their money?

Mr. Churchill: That type of testimony is irrelevant, your Honor. It is also highly speculative.

The Court: How does that help us, or have any probative value, whether they accepted it or not? Apparently this witness is trying to bring out that there was a general demand for this sort of thing in the trade.

The Witness: That's right, sir.

The Court: And you felt that if they paid for half the experimentation that you would be bound to them, is that right?

The Witness: That's right, sir.

The Court: But there was a general demand in the trade for such a thing?

The Witness: Yes, sir.

By Mr. Greene:

Q. How can we establish that there was a general demand; who demanded it; when did they demand it, and what? A. At that time you may recall the styles, women's styles were off the shoulder, and boning of all sorts was in very short supply. The styles did not use wire forms yet to any degree, so that Warren Featherbone was substantially on allocation. All the jobbers were in the same boat. They (85) couldn't get enough. The customers were wanting it, and they wanted to give them, if not that, something else which would do the same trick. So that the interest was paralleled throughout the dress and the foundation trades, which were affected by the same styles.

Q. Could they use acetate, cellulose acetate? A. They did, but they didn't like it, because it didn't make a good product.

Q. Well, was this demand for the product centered about a particular date or did it extend forward or backward of that date, of the date in '48; what is your knowledge of it? A. I would say the problem became acute in '47, and only—well, the problem was very strong up until last year. This year's styles have changed somewhat, and it has become modified, although it is still an important item.

Q. What are these notations on Exhibit 15 that you refer to?

The Clerk: P-15, formerly marked for identification, now marked in evidence.

(Received and marked Exhibit P-15.)

A. There are three samples, using the same braid, using an "H" acetate, "H" grade, an "MH" acetate, and "S" acetate.

Q. When were those notations made? A. Presumably about the same date, I believe, that we took the order.

(86) Q. Do you know that they were? A. Yes, I wrote that. It is my writing.

The Court: What do those various initials mean?

The Witness: "H" stands for hard, "MH" for medium hard, and "S" for soft.

Q. Did you testify with respect to the products, these cored plastics boning using cotton, braided cotton, as a core, are they shown here on Exhibit 8? A. That's the one that is missing.

Q. That's the one that is missing? A. That's the one that is missing.

Q. Were they made? A. It was made, yes, sir.

Q. And were they satisfactory or unsatisfactory? A. Unsatisfactory, completely.

Q. Because? A. They opened up. You could take hold of one end of the cotton and rip it right out of a length of a yard of the boning.

Q. What is the next product—what is the objection to nylon tape? You have testified, I believe, that you couldn't reproduce it. A. That's right, sir.

Q. Do you know why it couldn't be reproduced? A. No, sir; I don't. All I know is Mr. Rothman said he tried quite hard, quite some time, and we could not make it (87) consistently.

Q. Did you ever go into commercial production of it? A. No, sir.

Q. The next product listed on Plaintiffs' Exhibit 8 for identification is "Bonar." What is that? A. Well, that was the boning material which did the job. This is our trade name for this mixture which we have under discussion. It is sewable, stiff and enjoys an excellent sale, up to the present time.

Q. I hand you a card and ask you to identify that. A. Yes. This is a sample card from the Warren Featherbone Company which came to me in the mail from Warren Featherbone.

Q. When? A. I believe that is—within this year, quite recently.

Q. Is that the same featherbone as they have always made? A. Yes, sir; to the best of my knowledge it is.

Q. Is that a true sample of featherbone as it existed in '48, as far as you know? A. Yes, there is no observable difference.

* * *

(88) Mr. Greene: I would like to mark this for identification simply as a sample of Featherbone.

The Clerk: Marked P-16 for identification.

(Marked Exhibit P-16 for identification.)

By Mr. Greene:

Q. I hand you two pages, which bear the numerals 317 and 347, dated October 6, 1948 and October 20, 1948, and ask you to identify them, if you can. A. Well, this No. 317, addressed to Reuben Honig, attention of Mr. Bader, is for 300 pounds of black special acetate boning and white special acetate boning with five flutes.

Q. And what is this, did you say, a confirmation? A. Yes, that is a confirmation of a verbal order.

Q. And what is this second sheet? A. This is an acknowledgment, again of a verbal order for acetate boning in both black and white with fine flutes.

Mr. Greene: I would like to have these marked for identification. They can be one exhibit, A and B.

The Clerk: P-17A for identification, confirmation order No. 317; P-17B for identification, confirmation order 347.

(Marked Exhibits P-17A and P-17B for identification.)

Q. Will you compare A and B and tell me—of Plaintiffs' Exhibit 17 for identification—and state what they relate (89) to? A. Well, the first one, your No. 17, is an order for acetate boning with five flutes on it. It is a coarse fluted acetate.

The other one is the same type of order, but for fine flutes.

This was, I believe, one of the first—if not the first order for acetate with the coarse fluted pattern. I believe we have a sample of it mounted here.

The other one we used for what I call fine flutes and there were probably twice as many flutes in the same width of bone. This produces a heavier bone, also, and a stronger bone. You can just imagine two different styles which are being worked up to see which would form better.

The Court: What is the date of it?

Q. The date of it? A. One was—the five flutes, 17A, is October 6th, '48. And the other one is October 20, '48.

Q. Was the composition here cellulose acetate or something else? A. Plain cellulose acetate.

Q. What was the variation with respect to these boning materials over what you otherwise sold? A. Well, they had different surface patterns in an attempt to make better sewability.

Q. Did they? (90) A. They improved somewhat, but they didn't solve the basic problem of true sewability and breakage.

Q. When you say they didn't solve the problem of breakage, what do you mean, they broke? A. Yes, sir. When you had a couple of stitches through the bone, and the bone was flexed, it broke off.

Q. Exhibit P 17, A and B, are these confirmation and acknowledgments of Anchor Plastics? A. Yes, sir.

Q. Who are they made out by? A. I don't know who typed them, but I signed them.

You signed them yourself? A. Yes.

Q. Do you recall them as of that date? A. I don't—in a general way. That's a long time back.

Q. Do you recall the incident to which they refer? A. Yes, sir.

Mr. Greene: I will offer them in evidence.

(Documents handed to counsel.)

Mr. Churchill: I object on the ground that they have no relevancy to the subject matter of the patent in suit.

The Court: He objects to them. He says there is no relevancy.

Mr. Greene: Well, the relevancy is that they were attempting by different shapes to solve the problem of making (91) a sewable boning and one that wouldn't break.

The Court: For that purpose I shall permit it to be marked in evidence.

The Clerk: P-17, A and B, formerly marked for identification, now marked in evidence.

(Received and marked Exhibits P-17A and P-17B.)

By Mr. Greene:

Q. I hand you another paper bearing the No. 499. Will you tell me what you know about it, if anything? A. Yes, sir; this was our first order from a new firm, General Notion Company, for a patterned acetate boning. This was—

Q. What is the date? A. The date is February 9, '49. This is a pilot order. The man in this company, Tom Bader, was the sales manager of Honig, who left to form his own company, and we tried something new then, to press a pattern into the acetate, again to give him something different but better than plain acetate.

Q. What kind of a pattern did you press into the acetate? A. It was a knurled design. That would prevent the —take off the slippery surface which we associate with acetate and make it more on the—what we call the slip-proof side. We wanted to give it a sandpaper finish so the fabric jacketing wouldn't swivel around over the boning.

Q. Did it work? A. No, sir; it did not work.

(92) Q. Why? A. The knurled pattern pressed into the acetate made the acetate very sensitive, and it broke upon a very sharp flex without even being sewed.

Q. You mean the acetate was worse off than it was before? A. It was worse than it was before.

Mr. Greene: This paper bearing No. 499 I offer for identification as P-18.

(Marked Exhibit P-18 for identification.)

By Mr. Greene:

Q. Is this paper, P-18 for identification, signed by you? A. Yes, sir; it is.

Q. When was it signed by you? A. It was typed February 9, 1949.

Q. Do you recall the incident, the subject matter of that order, in respect to the date which is given there? A. Yes, sir. It was signed by Tom Bader, as marked.

Q. Tom Bader is the customer here? A. That's right.

Q. Is General Notions still in business? A. Yes, sir; they are.

Mr. Greene: I offer it in evidence.

(Document shown to counsel.)

(93) Mr. Churchill: I object. Only on the ground of lack of relevancy.

The Court: You offer it for the same reason as the others were offered.

Mr. Greene: The same reason.

The Court: It will be marked.

The Clerk: P-18, formerly marked for identification, now marked in evidence.

(Received and marked Exhibit P-18.)

By Mr. Greene:

Q. I hand you paper 1189 and ask if you will identify it, if you can. A. Yes, sir. This is an order from Reuben Honig for a thousand pounds of Bonar material on February 28, 1950.

Q. Who is Reuben Honig? A. That is the company with whom we had been dealing. It is for shipment to Fashion Arrow Fabrics, who do the jacketing for them. Fashion Arrow is a contractor for Reuben Honig and we customarily ship Honig's orders to Fashion Arrow for working.

Q. What is the order for? A. 600 pounds of white Bonar, 050 x 200, and 400 pounds of black Bonar in the same size.

Q. Did you sign that order? A. This one is signed by Mr. Fisch, under Mr. Seckel's initials.

(94) Q. Do you recognize his writing? A. Yes, those are Peter's initials.

Q. Is this Mr. Honig's signature? A. No, it was signed by Leonard Wilkenfeld for Reuben Honig, for the company.

Q. Did you observe either of these signatures, or both of them? A. I can't speak for this one (indicating), but this (indicating), in my presence, normally.

The Court: He can't speak for Fisch's, but he can speak for Honig's.

Q. Do you recall the sale of Bonar on or about February 28, 1950, to which this refers? A. Yes.

• • •

By Mr. Greene:

(95) Q. I have this letter here from Standard Tape, will you tell us what you know about it. A. Standard Tape

is one of the companies I went to to get get braid or tape for experiments. After I got the first samples from them I turned it over to Peter Seckel, who did the rest of the work, purchasing, and followed through on it. This letter, addressed to Peter Seckel's attention, relates to two samples which he apparently requested from them for the work on either acetate or nylon coring.

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(96) The Clerk: P-20 for identification, letter dated February 24, 1949.

(Marked Exhibit P-20 for identification.)

The Court: I will grant that generally this type of litigation is characterized by a minimum of objections.

By Mr. Greene:

Q. This is a confirmation order dated April 25, 1949. Will you say what it is, other than that? A. Well, this is a confirmation from the Loveable Brassiere Company at 358 Park Avenue, New York, for 100 to 125 pounds of Bonar, a sample run to go to ReJune Brassiere Company, 4014 Park Avenue, in the Bronx. This is my signature on it. And, as I recall, this was a sample run for ReJune Brassiere Company, who are affiliated with the Loveable Brassiere Company.

Q. What is the product involved? A. Brassieres.

Q. What is the product that was sold here? A. Bonar.

(97) Q. Is this the Bonar, the new product we have been discussing all along? A. Yes, sir.

Q. And this sale took place April 25, 1949? A. Yes, sir.

Q. Of your own knowledge? A. Yes, sir.

Q. Your own signature? A. Yes, sir.

Q. Do you know that it was delivered, this order? A. Not of my own knowledge. I presume it was delivered.

The Court: Isn't there a receipt on the bottom?

The Witness: No, sir; that is the acceptance of the order.

The Court: I see.

Mr. Greene: I ask that this be marked in evidence.

Mr. Churchill: I have no objection to this for what it shows, but I do not accept the statement of Bonar on this order as meaning that it was made from the admixture of cellulose acetate and cellulose acetate butyrate, to extrusions.

The Court: Can you help us out in that regard, Mr. Dick?

The Witness: Yes, sir, that was our trade name for the product.

By Mr. Greene:

Q. What did you use the name Bonar for? A. For this mixture of acetate and butyrate, which we have (98) under discussion here, and for nothing else.

Q. Are you sure you never used it for straight acetate. A. No, sir.

Q. Did you use it for any of these reinforced tapes or anything else? A. No, sir.

Q. Did you use it for any product other than the combination of cellulose acetate and cellulose acetate butyrate in strip form, sold for boning? A. No, sir; we didn't. In fact, the first few orders of this mixed product was sent out before we worked up the trade name Bonar to identify.

Q. Can you say that you are certain, therefore, that "Bonar meant the product which is the subject of the patent you are so familiar with? A. I am positive of that.

The Court: It may be marked.

The Clerk: P-21, confirmation order No. 588.

(Received and marked Exhibit P-21.)

Q. Now, will you tell us what you know about the sales of Bonar, which is a strip of cellulose acetate and cellulose acetate butyrate, immediately after it came into production by Anchor Plastics Company, and when that occurred? A. Well, the first—I believe the first two months after we came out with it—

(99) Q. When? A. The beginning of '49—there was a period of trial and error and a lot of objection from the trade. And for a little bit it looked as if the objection would be against us again, because of a pattern of testing that they had a habit of going through. They would sew the material lengthwise to test it, in spite of the fact that it was never done that way commercially. When it was sewed lengthwise it would split in half. They got indignant and threw it out.

But in spite of that slow start—oh, in the first year, or 14 months, we sold, I believe, about eight and a half million feet of Bonar, while in the same period we sold about three or four and a half million feet of plain acetate boning. And of the acetate virtually all of that sold in the early days of Bonar. The Bonar took over the acetate, as far as we were concerned, completely, until today, I believe, in the foundation trade it would be very difficult, if not impossible, to sell anybody plain acetate when they want to use a plastic boning.

Q. What is the foundation trade? A. The foundation trade I would say would cover brassieres, some include swim suits in that—plastic boning is not, as a rule, used in corsets, so I would restrict myself to brassieres, some lightweight corselettes, and swim suits, as far as we are concerned now.

(100) Q. What do they use acetate for; who uses acetate? A. That is used in the dress trade where—they have

a fantastic price situation, and because this fluted acetate boning can give about 90 yards to the pound, versus the present 60, 65 yards for Bonar, on a comparable size. The acetate winds up that much more cheaply, plus the fact, of course, that pound for pound the acetate is also cheaper than Bonar. It is sold for a lower price. Those manufacturers who are sweating out low price garments, while they have to save every mill they can, and they go for the acetate. They let the customer worry about the garment staying up.

Q. Do you sell acetate any more? A. No, sir.

Q. When did you stop selling acetate? A. I think we sold some right through 1950. I think our last customer for that was Quest-Shon Mark in Brooklyn, who are a good tribute to the quality of acetate. They are bankrupt, of course.

Q. Do you get more for Bonar than you got for acetate, or does the customer pay more? A. Yes, sir.

Q. You don't make acetate at all any more? A. No, sir.

Q. In the form of strip boning, I am talking about. A. No, sir.

(101) Q. Can I say that as for a comparison of sales after that first year's period—or have you given that, in 1950; which was the second year here—how did sales of acetate and Bonar vary with respect to one another? A. Well, after the first year there really wasn't any more comparison. Acetate was historical, as far as I was concerned, in boning. It belonged along with whale bone.

Q. Are those questions settled by you in determining what product to make, or by the customer who buys, or the trade who uses it? A. Settled entirely by the customer. We would make whatever they wanted.

Q. Is anyone else in the trade presently making the product that you term Bonar, a definition which we both know, at this time? A. Yes, sir. We distribute this mate-

rial through—a good deal of it—through Durable Supply, who have competition, infringing competition from, I believe—it is Just-Rite or Stay-Rite, right next door to them on Waverly Place—I get those two mixed up—Mr. Willon's company.

Q. Do you know who the manufacturer of that product is? A. No, sir; not of my own knowledge.

Mr. Churchill: I will be very glad to stipulate that Keystone Plastics Company supplies the strip material to Mr. Willon's company, Just-Rite Novelty Company.

(102) *By Mr. Greene:*

Q. Is there anyone else, to your knowledge, competing with you; do you run into anyone else's product? A. No, sir; that's my prime source of irritation at the moment.

Q. My question wasn't very clear, but what I meant to say was is there anyone else that you know of that makes this same product that you call Bonar other than Keystone, who has been said here to supply the sole competitor for that product that you do have? A. No; I don't know of any others.

* * *

Q. I have here a confirmation order. Will you describe it to me. A. This is a confirmation copy returned to us from Silmar (103) Foundation, 15 East 31st Street, signed by Ralph Marcus, dated April 14, '49. It is for 100 pounds of fibrous aeroflex acetate boning, as sample supplied.

Q. What is that description? A. We had not nailed down the name Bonar yet. We had used this name fibrous I think we were using the name Aeroflex, and we later on dropped that. But that was the Bonar material which was supplied to him at that time.

Q. Do you recall that transaction? A. Yes, sir. I brought samples which were tried out there, brassieres were made up, they were worn by his girls there for three or four weeks there, they seemed to be all right, and he gave us this order for 100 pounds to try it on production.

Q. Was this one of your early orders for Bonar material? A. Yes, it was in the beginning. It wasn't one of the third, though. But this is the typical way you opened up a new account—samples, pilot runs, and so forth.

Q. Is this order signed by you? A. Yes, sir.

Q. Was the material called for in the order of a hundred pounds delivered? A. Yes, sir.

Q. How do you know? A. If it hadn't been delivered I would positively know about (104) it.

Q. What was the delivery date? A. It was delivered about a week from receipt of this order. We have a specific delivery date here.

Q. Pointing to the exhibit? A. That's right. April 21st.

Mr. Churchill: No objection.

The Court: It may be marked.

The Clerk: P-22, confirmation order No. 577.

(Received and marked Exhibit P-22.)

By Mr. Greene:

Q. This then was in the early days of selling Bonar, and this was in April, 1949, is that correct? A. That's right.

Q. What happened right after that, did the sales of Bonar accelerate? A. Yes, they picked up very steadily. As a matter of fact, we started getting our competition at that time, pretty soon.

Q. What competition was that? A. Well, I believe the first competition was World Plastics. They copied our Bonar pretty quickly.

Franklin Dick, for Plaintiff— Cross

Q. When was that, about?

Mr. Churchill: I object to the witness' characterization of how World Plastics got into the field.

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(105) Q. When did you come into the competition of World Plastics? A. According to my best memory, it would probably be around April of that year.

The Court: Of '49, you mean?

The Witness: I believe it was '49; yes, sir.

The Court: Right after you started.

The Witness: Yes, sir. They kept in our hair until we—they signed a consent decree.

Q. Other than that did you have any competition—and the ones you mentioned before? A. Nothing besides our present situation.

Mr. Greene: That is all.

Cross-examination by Mr. Churchill:

Q. What is your academic background, Mr. Dick? A. No special training, sir.

Q. Did you graduate from high school? A. Yes, sir.

Q. Did you graduate from college? A. No, sir.

Q. Did you ever study chemistry? A. No, sir.

Q. Where were you employed prior to entering the
(106) employ of the plaintiff, Anchor Plastics, Inc.? A. Whiteford Plastics.

Q. What did you do at Whiteford? A. I was a salesman there, sir.

Q. How long were you employed at Whiteford Plastics? A. About six months, sir.

Q. That was in 1946? A. That's right.

Q. Did you have any other connection with the plastics industry prior to being employed by Whiteford Plastics?

A. Yes, sir; before that I was in the Army, and prior to that I was with the Lumelite Corporation. I was there for about a year and a half.

Q. What did you do for Lumelight Corporation? A. I was the assistant to the president.

Q. Did you ever do molding, extrusion molding yourself? A. No, sir.

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(112) Q. Well, now, referring to the chart which has been marked in evidence, or marked for identification as Plaintiffs' Exhibit P-8, will you state who suggested the use of fluted acetate?

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A. I don't recall who in our organization picked up the idea at this time, but it started at Anchor Plastics, to the best of my knowledge and belief.

Q. It wasn't your idea? A. I don't recall.

The Court: Wait a minute. Do you mean it might have been your idea?

The Witness: It might have been; yes, sir.

The Court: But you don't remember?

The Witness: That's right. Ideas aren't that scarce (113) around Anchor Plastics, sir.

The Court: You must have a lot of them.

The Witness: We do.

By Mr. Churchill:

Q. Who suggested using acetate around cotton? A. I can't honestly say I remember. I may have very well been the culprit on that one.

Q. Who suggested using polyethylene and wire? A. That I can't recall. That may have been Peter Seckel. I wouldn't want to swear to that, either.

Franklin Dick, for Plaintiff— Cross

Q. Who suggested nylon and wire? A. I believe that was mine, sir.

Q. That was yours? A. Yes, sir. Also the nylon and tape.

Q. And who suggested the acetate and other tapes? A. I did, sir.

Q. Now, under direct examination you said "we" thought of trying this and "we" thought of trying that, I believe. Who constituted the "we"? A. By and large, I would say Myron Rothman, Mr. Fisch, Peter Seckel, myself.

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(114) Q. What is Bonar sold for? A. To our distributors, a dollar seven a pound, sir.

Q. What is Bonar jacketed sold for? (115) A. Now, this is not first-hand information again, sir, but that, to our distributors, I believe, runs around six dollars to six dollars and a half for the same gross yards.

Q. So that the price differential between cellulose acetate jacketed and Bonar jacketed is the difference between five dollars and six fifty for the same yardage? A. That's right.

Q. What did you contribute, if anything, toward the final development of Bonar, as such? A. Just sales department pressure upon Mr. Seckel and Mr. Rothman to get moving.

Q. You impressed them with the need for product, is that correct? A. Yes, sir.

Q. And you suggested to the research men three ideas of your own as to how this product might be evolved, is that correct? A. Yes, sir; partially.

Q. And you did not consult any other material suppliers in the plastic field as to what type of plastic would be suitable for your customers' use? A. I did not, sir.

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Myron Rothman, for Plaintiff—Direct

(117) Q. In talking to Mr. Fisch and Mr. Seckel, prior to the development of Bonar, did you stress the desire of the customer to be able to sew across the stay material? A. Yes, sir; the customers wanted to sew across, and they wanted to sew lengthwise, also.

Q. And that was stressed to Mr. Fisch? A. Yes.

Q. And to Mr. Seckel? A. Yes, sir.

Q. And to Mr. Rothman? A. Yes, sir.

Q. And that was stressed before the invention of the patent in suit was evolved, is that correct? A. Yes, sir.

Q. So that Mr. Seckel and Mr. Fisch well understood that one of the prime purposes was to be able to sew across this boning material? A. Yes, sir.

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(118) MYRON ROTHMAN, called and sworn by the plaintiff, testified as follows:

The Clerk: May we have your full name and address, please, sir?

The Witness: Myron Rothman, 3521 DeKalb Avenue, Bronx 67, New York.

Direct examination by Mr. Greene:

Q. What is your occupation, Mr. Rothman? A. I am plant superintendent at Anchor Plastics Company, Incorporated.

Q. What do you do when you act as plant supervisor? A. Well, it is my job to take the job, design a new die, if necessary, help decide on the type of extrusion that would come of it.

The Court: You mean best suited for the job?

The Witness: And sometimes to decide what material is (119) to be used.

Q. When Mr. Dick goes out and gets the job, how is that handled back in the plant? A. If it is something of a new die or a new extrusion that is necessary, he brings the job in, and he presents it to Mr. Seckel. And Mr. Seckel, I, sometimes Mr. Fisch, would take the job and see if it were in our—see if we can do the job, if it isn't too big for our machines, or anything like that.

Q. What kind of strips do you extrude? A. Now?

Q. At Anchor Plastics. Yes. A. We extrude what we now call Bonar.

Q. What else do you strip extrude? A. Very little strip extrusion.

Q. What is your past experience, what have you extruded in strip form in the past, other than Bonar? A. Well, we extruded the acetate strip, we extruded polyethylene strip.

Q. Was polyethylene strip a commercial product? A. Yes. It still is.

Q. What was that used for? A. They use it for webbing. One time we extruded it for chair webbing, handbag handles and—oh, well, that's mainly what it is.

(120) Q. Have you ever had much occasion, or any occasion, to experience contamination because of the proximity of a job in which you used acetate with respect to a job in which you used acetate and butyrate? A. There were times that we had some contamination.

Q. How was that contamination manifested, how did you notice it, what form did it take? A. Well, you usually would see a pimply surface of material, where it wasn't glossy, and you would just have a surface that would come out and would be pimply, not that it was the way it should be.

Q. Did such a product get by to the customer? A. No.

Q. What do you do then? A. Usually discard the material.

Q. I have here Plaintiffs' Exhibit 8 for identification, which is the title and sample listing of the developments that really came before Bonar. Will you very briefly state your knowledge with respect to these developments, when they took place, what happened to them?

The Court: Start from the top down, please.

A. Well, in earlier '47 we were making this acetate boning for Reuben Honig, as Mr. Dick stated, and we went along with that, and as we were going along we always had comments from Mr. Dick to try to get a better boning. And from that (121) we tried several other means, similar to this fluted acetate boning, which also didn't serve the purpose as it should. We developed—or, rather, we experimented with several different ways of manufacturing a boning that would be more satisfactory, like covering the acetate—rather, covering a tape with acetate, with which we had considerable difficulty, because the tapes were never uniform, they were never long enough, they were knotted, which gave us considerable trouble in running.

Q. Why is it bad if the tape is not uniform, or knotted? A. We couldn't properly process it through our machines.

Q. You mean it couldn't get through the die, or something like that? A. Right.

Q. By the way, who thought of fluted strip, do you know? A. Well, that is something that came out of discussions that we usually have on anything new that we are working on, which comes out—most any of us might have thrown the idea in, and we picked it up, Mr. Dick, or Mr. Fisch, Mr. Seckel or myself. We usually have sessions discussing the problems, and what we should do about them.

Q. What happened to the fluted acetate boning strip? A. Well, there was—it evolved from conversations that we had to try to get a boning that would be a little more suitable to the trade.

(122) Q. What happened to it? A. What do you mean, what happened, why we don't run it any more?

Q. Did you run it? A. Yes, we did run it. We ran several styles of fluted boning.

Q. How long did you produce it? A. I'd say about two years.

Q. Why did you stop producing it? A. Because we—we stopped it because—I guess mostly because the customers didn't want it any more, in preference to our Bonar.

Q. With respect to the other listed experiments listed in that exhibit, P-8 for identification, when were they carried out, if you know? A. Well, most of the experiments were carried out in 1948.

Q. Call them off. There are only a few of them there. A. In experimenting on a Bonar that would be soft enough for a needle to penetrate without breaking—

Q. Did you say "Bonar" then? A. No, boning.

Q. Boning. Good. A. And we tried to cover wire with polyethylene, because it was a softer material, and thought that that might do the trick. But we found that it was objectionable because of (123) the wire that was inserted in the polyethylene, it wasn't satisfactory to the garment manufacturer.

Q. Why? A. Because after you flex the boning the wire would stick out at the end.

Q. All right. What happened then to that particular product, did you put it in production? A. We put it in production in a different form.

Q. What different form? A. We have what we call a Polyseal which came out of this.

Q. What is that used for? A. That is a bag closure.

Q. Did you ever make it and sell it a boning material? A. We made a quantity of it. I don't remember if it was sold as a boning or not.

Q. Do you make it now? A. We don't make it now.

Q. Have you made it for any number of years past as a boning material? A. No, not for a boning material.

Q. What is the next experiment there? A. Well, the next experiment was wire and nylon, which we covered the wire with the nylon as a stiffening agent. Mr. Seckel himself had worked on that a great deal.

(124) Q. What happened to that? A. I don't think it was suitable. It was an expensive—nylon being an expensive item. It didn't seem to be suitable for that work, either.

Q. Did you put it in production? A. No.

Q. What is the next experiment? A. We still tried some other tapes with acetate, rayon tapes, which we tried because we weren't successful with the cotton; we tried various tapes, trying to get them to form better with the acetate, tried to make a bond which would be better than the cotton tapes and acetate.

Q. Did it work? A. Which was also not successful.

Q. Did you make any production runs? A. No, sir.

Q. Do you make them now? A. No, sir.

Q. What is the next one? A. The next is a nylon tape which we tried, which was similar to the acetate tape. We had a little more success in running the original experiment with nylon. We had a lot of trouble, also, with the tape, similar to the other acetate tapes. But the initial experiment was a little more successful, but we were never able to duplicate that again.

(125) Q. Why couldn't you duplicate it? A. The similar trouble of getting the nylon to adhere to the cotton.

Q. Did you ever put it in production? A. No, sir.

Q. Was the nylon tape the last experiment, as it is the last experiment on the list? A. Yes, it was the last experiment before the Bonar.

Q. What was done with respect to the Bonar development? A. Peter Seckel was working on the Bonar experi-

ment himself. He was working on our lab extruder. He at one time gave me a mixture of Bonar to try out on our larger machine, which at that time I didn't—personally didn't think it would work. And from that we had gotten our Bonar.

Q. What was the mixture that he gave you? A. Oh, we tried 60 per cent of acetate to 40 per cent butyrate, and other various amounts, going down.

Q. When you say acetate do you mean cellulose acetate? A. Cellulose acetate.

Q. When you say butyrate, you mean— A. Cellulose acetate butyrate.

Q. Did you make any other runs of your own, or at any one else's direction, with respect to combinations of plastic materials? A. Yes, we made several other combinations.

(126) Q. Did you make them yourself? A. Under my supervision they were made.

Q. At your direction or the direction of someone else? A. At the direction of Mr. Seckel.

Q. Do you recall what those combinations were? A. Yes, we have made acetate with ethyl-cel.

Q. Any other? A. Yes, we tried acetate with polyethylene. We tried—I believe we tried styrene with acetate.

Q. Did they work? A. Not as well as the acetate and the butyrate. They had a similar appearance, but they didn't work as well.

Q. Which one are you referring to? You said "they" had a similar appearance. You mean a similar appearance to the outside of Bonar, inside, or what? A. The outside of Bonar.

Q. Did they have an appearance similar on the inside? A. They were similar, some of them were.

Q. In what respect? A. That they were of a long fiber.

Q. Which ones are you talking about? A. Ethyl-cel and acetate.

Q. Did you try any of the Bakelite compounds? A. No.

Q. Phenol formaldehye, urea formaldehyde? (127) A. No.

Q. Did you try vinyl compounds? A. No vinyl compounds.

Q. Nylon? A. We tried the nylon with the tape, yes.

Q. Polythene you did try? A. Yes.

Q. Styrene? A. Yes.

Q. And you used cellulose acetate as the other component? A. Yes.

Q. As one component? A. Right.

Q. Did you use any other cellulose compounds? A. Well, the butyrate.

Q. Did you ever use cellulose nitrate? A. No.

Q. Why? A. Well, it's a high explosive material. It wasn't for that process of extrusion that we used.

Q. Did you ever use an ethyl cellulose? A. Yes. That was the ethyl-cel.

Q. You used polythene, too? A. Yes.

Q. That's a resin, isn't it, polythene? (128) A. Polythene is a thermoplastic extrusion material.

Q. Which of these combinations did you find to be the most suitable for the purpose? A. The combination of cellulose acetate and cellulose acetate butyrate.

Q. Why was that? A. Well, it proved to be the best combination.

Q. For what result? A. Well, acetate in itself was an inexpensive material, which was the major thing we were looking for, and the combination with the butyrate gave it its proper content of fiber to simulate that of the Featherbone, which we were trying to duplicate.

Q. In the previous experiments on braids here, and these reinforcements, did each man have a project there,

or was that—did that come out of round table discussion? A. It was never an individual project, excepting when we were tied up, maybe one person might have spent a little more time on it than another, but always the end result was out of discussion.

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(132) *Cross-examination by Mr. Churchill*:

Q. How old are you, Mr. Rothman? A. 37.

Q. When did you enter the employ of Anchor Plastics Company? A. October of 1945.

Q. Where were you employed prior to October of 1945? A. National Plastic Products Company in Odenton, Maryland.

Q. And how long were you employed there? A. Approximately three years.

Q. And prior to that time where were you employed? A. In New York City.

Q. By what company? A. Howard Machinery Company.

(133) Q. And what did you do for Howard Machinery Company? A. I was a machinist.

Q. When did you have your first experience with plastics? A. It was in Baltimore, Maryland, at— it was originally the National Store Fixture Company.

Q. When was that? A. Around 1942.

Q. And what was your assignment, or job, with that company? A. Well, I originally started as a machinist there, and they entered into the plastics business, and I was put into the plastics department.

Q. Doing what? A. First as a machinist, maintaining their machinery, and then I was put at the head of the extrusion department.

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(134) Q. Did the company do extrusion molding? A. Yes.

Q. Did it make strips? A. No, we didn't make strips, we made sectional shapes and wire.

Q. Plastic wire? A. That's right.

Q. What type of materials were used in 1943? A. At that time our primary material was ethyl-cel.

Q. That's ethyl cellulose? A. That's right.

Q. Did you use any cellulose acetate? A. Yes, we used cellulose acetate and cellulose acetate butyrate.

Q. You used both of them in 1943? A. Yes.

Q. For extrusion purposes? A. That's right.

Q. Did you ever see any labels on the drums in which cellulose acetate was received? A. Yes.

Q. What did the labels say, as you recall it? A. It was a red label, labeled Tenite 1.

(135) Q. What else did it say? A. Well, there were various—gives you the material, the flow, the formula, the color.

Q. Did it also say, "Do not contaminate or mix with other materials"? A. Do not mix with other materials.

Q. So that Tenite 1 had a red label, is that correct? A. That's right.

Q. With an admonition, "Do not mix with other materials." A. Yes.

Q. What kind of label did Tenite 2 have? A. It had a blue label.

Q. And what did it say? A. Tenite 2, similar, "Do not mix with other materials." No, it said, "Do not mix with Tenite 1," I believe.

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(156) *By Mr. Churchill*:

Q. I show you the photostat of a Tennessee Eastman invoice, which has been marked for identification as D-5, and ask you if you recognize having seen that notice on such invoices? A. Yes.

Q. Would you read it, please? A. "Do not mix with Tenite 2."

Q. It is Tenite 1—"Do not mix with Tenite 2." A. Yes.

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(161) Q. When Mr. Seckel gave you an admixture of cellulose acetate and cellulose acetate butyrate and asked you to run it through your extruder to form a strip, what did you expect to get? A. Far from what I did get. I didn't expect to get the results we got.

Q. What did you expect to get? A. A pimply surface material.

Q. Well, wasn't it pimply surfaced? A. No, sir.

Q. It was not uniform in cross section, was it? A. Yes, sir.

The Court: It was uniform?

(162) The Witness: Yes, sir.

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(163) The Clerk: P-23 for identification, card containing series of six labels.

(Marked Exhibit P-23 for identification.)

Redirect examination by Mr. Greene:

Q. What does this card, P-23 for identification, contain? A. They are labels that are on the drum and the cover of the drum and an invoice copy.

The Court: Of Tenite?

Mr. Greene: Just let me show it to counsel.

The Court: Yes, he may consent to its being marked in evidence.

(Shown to counsel.)

Mr. Churchill: Yes, I have seen it.

Mr. Greene: Any objection?

Mr. Churchill: None at all.

The Clerk: P-23, formerly marked for identification, now marked in evidence.

(Received and marked Exhibit P-23.)

Mr. Greene: This, your Honor, is a card that contains (164) the labels that were used by Tennessee Eastman and by the other producer, Celanese Corporation, at the time of this invention and prior thereto. We received those from Eastman, just like he received those invoices. That invoice down there is a sample invoice which they sent to us, too, the same as his. That's 7.

The Court: I see that.

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(165) *By Mr. Greene:*

Q. Can you testify, Mr. Rothman, as to whether or not these labels, and this invoice, were used on all Tenite raw materials, powders, that you used in the plant, prior to the date of this invention—A. Yes, sir.

Q. —which is 1949, about? A. Yes, sir.

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(166) The Clerk: P-24 in evidence, two labels, Tenite acetate and Tenite butyrate.

(Received and marked Exhibit P-24.)

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Myron Rothman, for Plaintiff—Redirect

By Mr. Greene:

Q. What did these labels mean to you, as a molder, what was the effect on you? A. Well, the label in itself would be a marking on the drum to distinguish one plastic from another and keep them separate.

Q. What is the effect on you of the "Do not mix with other materials" or "Tenite 1 or Tenite 2" that is contained on these labels? A. They would result in a product that is not usable.

Q. Well, in what respect would it not be usable? A. It wouldn't be—well, you probably couldn't get the cross section that you would want, mostly, and it would result (167) in a bad product.

Q. What did you do in those instances that you have described where you have experienced contamination before Tenite 1 and Tenite 2? A. What did we do with it?

Q. What did you do with the product? A. We threw it away.

Q. Did you ever call the boss over and say, "Here is an interesting product"? A. I don't recall that. I don't think so.

Q. Did it look like a product that you could sell? A. That which resulted, and that which—when it did occur in contamination, no.

Q. When you say a "pimply surface"—one of these calls it "scaling"—I see different expressions—what does it look like, actually, in more detail than "pimply", if you can give it? A. Well, it is not a uniform surface. I don't know how else to describe it. You can call it scaly, you can call it a lot of things.

The Court: I should imagine there would be a difference between a pimply surface and a scaly surface.

The Witness: Well, no, a lot of times—it's all according to the material that was contaminated. There are several different—they give you different descriptions of (168) different results, too.

The Court: What does "lamination" mean, exactly?

The Witness: Well, you have particles one on top of another.

The Court: Would a pimply surface be one like you would find on aluminum sometimes?

The Witness: No, that is not a pimply surface.

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(186) Q. You mentioned before, in your cross, speaking of—I think it was vinyl chloride as being a fibrous material. I am not quite clear on that. If you extrude vinyl chloride in the form of a strip or a rod, what do you get then? (187) A. You get a strip or a rod in a solid cross section.

Q. Is it a bundle of fibers? A. No, it is not a bundle of fibers.

Q. I don't even know if I am sure—did you use the word "fibers" in connection with that particular piece? A. I believe he asked me if—he referred to poly vinyl chloride, if it was a fibrous structure. In manufacture you can, in some cases, get a piece of a monofilament that may peel, similar to a fibrous structure. It is not a fibrous material in the sense of a fibrou material, but there is a fibrous structure. You might be [illegible] to split it, taking a horse hair, or something, you might split it. In that sense, yes.

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Myron Rothman, for Plaintiff—Recross

(189) *Recross examination by Mr. Churchill:*

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(195) Q. I show you what has been marked as Plaintiff's Exhibit P-23, and particularly call your attention to the caution label which you said appears on the cellulose acetate put out by the Celanese Corporation— A. Yes.

Q. —and ask what do you understand by the word "laminated" which is used on that caution label? A. Well, that you would have laminates of material, one on top of the other.

Q. Layers? A. Layers.

Q. And those layers could run the whole length of the strip, could they not? A. I don't know.

Q. Well, the word "lamination" means that there is one layer on top of another, does it not? A. Yes, but I don't know if it would run the whole length (196) of the strip. I have seen laminates that would last several thousandths of an inch, like a scale. That's a laminate.

Q. But a laminate means that you have a strip which can be peeled off. A. Yes.

Q. And that laminate is joined to another laminate in some way, but they can be separated by pulling them apart? A. Yes.

Q. So that you understood that with the use of cellulose acetate and admixing some other plastic with it, that cautioned you against producing laminates, is that correct? A. Yes.

Q. Is Bonar a laminated material? A. I wouldn't say it is a laminate.

Q. It can be peeled off in strips, can it not? A. It doesn't peel in strips, it peels in long continuous fibers.

Q. But they can be separated one from the other? A. Yes.

Franklin Dick, for Plaintiff, Recalled—Direct

Q. The same way that laminations can be separated one from another? A. In a similar way, yes.

Q. And you understood that prior to 1948, that laminations would be formed? A. I don't remember us running too much Celanese prior to (197) that time.

Q. Well, you understood the label. A. When I had seen it, yes.

Q. That it would give rise to laminations? A. Yes.

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(201) FRANKLIN DICK, called for the plaintiff, having been previously duly sworn, testified as follows:

Direct examination by Mr. Greene:

Q. Mr. Dick, in your testimony yesterday—will you continue that in the sense that you will tell us if you did sample out Bonar to the customers that you sold to—did you sample out this Bonar? A. Yes, sir.

Q. When did you sample it out first? A. Immediately after it was made.

Q. When was that? A. That was in February of '49.

Q. To what customers did you sample it out? A. Well, there are five that I know of for sure. There may have been others.

Q. Will you give us those five, or whatever you do know? A. The first was Reuben Honig.

Q. Generally identify their address, if you can? A. Reuben Honig was and is at 580 Eighth Avenue, New York City. There was the Loveable Brassiere Company, which at that time was at 365 Fifth Avenue. There was the William Glucken Corporation, which at that time was on 23rd Street near Sixth Avenue. And there was the Glucken

Corporation on 14th Street between Fifth and Sixth Avenues.

Q. Is that the same company? (202) A. No, they are two different companies. The same family. And the Silmar Brassiere Company, who were, and I believe still are, on 32nd Street between Fifth and Madison Avenues in New York City.

Q. Is that the list? A. Yes, sir.

Q. When you say "sample," how much Bonar did you give them? A. I believe Honig got a coil of possibly anything from five to ten pounds. The others, 20 to 40 yards apiece, initially.

Q. When was it that this material, Bonar, was actually delivered to the people you listed? A. It was brought by me personally right after we made it and I saw it had prospective value.

Q. And when was that again? A. That was in February '49.

Q. All of it? A. Yes, sir.

Q. How much Bonar did you sell before November, 1949? A. I believe it would add up to about two and a half million feet.

Q. Where was that sold, largely? A. Honig bought a good deal of it, Loveable has started using it. I believe both Glucken corporations had used it. There may have been a few other strays, but those are the principal (203) customers.

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Peter H. Seckel, for Plaintiff—Direct

(204) PETER H. SECKEL, called and sworn for the plaintiff, testified as follows:

The Clerk: May we have your full name and address, please?

The Witness: Peter H. Seckel, S-e-c-k-e-l, 111-05 62nd Drive, Forest Hills, New York.

Direct examination by Mr. Greene:

Q. What is your occupation, Mr. Seckel? A. I am now the assistant manager of Anchor Plastics Company, Incorporated.

Q. What do you do in your job, what is your function? A. I help with the general administration at Anchor Plastics and I still take care of chemical problems as they arise now.

(205) Q. Will you state for the record your education? A. I first went to school in Germany and then attended high school in England. I continued high school—they have a slightly different system there—until I had nearly attained the intermediate B.S. degree. I then continued studying at night whilst I was employed in England.

Q. What did you study in the schools that you went to in England? A. I specialized in the science subjects of chemistry, physics and mathematics.

Q. What did you study at London University? A. Mostly chemistry.

Q. Do you have an intermediate B.S. degree? A. Yes.

Q. In what subject? A. In chemistry.

Q. How many years did you study at London University? A. This was evening study during the war, with many interruptions. A total of about six years.

Q. Did you have any other study or educational activities? A. Yes, when I came to America I continued studying at the City College of New York.

Q. What did you study there? A. I studied business administration.

Q. What was the nature of the various employments (206) that you have had? A. My first employment was in England with the Ministry of Supply during the war. I was employed as an assistant chemist.

Q. What was the nature of the problems that you dealt with as assistant chemist? A. We were concerned at that time with war products of one kind or another, mostly in the plastics and in rubber.

Q. What kind of plastics did that involve? A. At that time we were dealing mostly with vinyl plastics.

Q. What was your next occupation? A. I then joined the Rubber Improvements Limited Company in London. That was in 1945.

Q. What did you do there? A. I was first a chemist and then the assistant chief chemist. And we were working first with rubber and then with vinyl compounds.

Q. What did you do after that employment? A. I left Rubber Improvements—I think it was in January of 1947—and then joined Stadium Limited, also in London.

Q. And what did you do there? A. At Stadium Limited I was the chemist and I was to be in charge with the establishment of a plastics compounding plant.

Q. Were you connected with that? A. Yes.

(207) Q. Where was that plant located? A. The plant was to be located in Wales. It was to be built with machinery obtained in the United States. By permission of the British Government I came over here to buy the machinery.

Q. When? A. In 1947. And then due to the dollar shortage in England that project was not completed.

Q. What did you do next? A. I came over here in early 1948 and joined the Rubber—pardon me—the Moldex Company in Philadelphia.

Q. What did you do there? A. I was the chemist. And Moldex manufactured rubber products.

Q. What type of plastics did they concern themselves with at Moldex? A. I do not think we worked on any plastics at that company.

Q. What did you work at? A. Only rubber and synthetic rubber.

Q. How long were you there? A. Until the Fall of 1948.

Q. What synthetic rubbers did you work with? A. We were working with neoprene and G. R. S.

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(208) Q. Did they do any extrusion molding at Moldex? A. Yes, we extruded rubber shapes.

Q. What was your next employment? A. I then joined, in August of 1948, Anchor Plastics.

Q. What was your function on joining Anchor Plastics? A. I was hired as a chemist.

Q. What did you actually do as a chemist for Anchor Plastics? A. We were working on a problem of molding vinyl plastisols at first. We continued those experiments, but I was, of course, also asked to help with other chemical problems that arose.

Q. What were the other chemical problems? A. Well, one of the problems was to find a better boning.

Q. When was that? (209) A. The problem already existed, to my knowledge, when I joined Anchor Plastics. They had already began experiments at that time to find a better boning.

Q. Why did they need a better boning? A. Mr. Dick pointed out to us that acetate boning was not equivalent to Featherbone.

Q. In what respects was it not equivalent? A. Featherbone, when repeatedly flexed, would not break off like regular acetate would; it could be sewn through, which acetate could not, because the needle usually broke, or if it didn't, the boning would break shortly after it had been penetrated.

Q. Well, what did you do about that problem? A Well, we tried to use nylon as a material, and to reinforce it we used wire inside it.

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Q. For convenience I am handing you a card entitled P-8 for identification, which you have seen before, and it has (210) a number of samples on it. Will you tell us briefly what you know about that card. A. Up to the time I joined Anchor Plastics I believe they had gone through the making of regular acetate boning, and of fluted acetate, which I saw when I joined it, when I joined the company: they had already made some experiments of coating cotton braid with regular acetate; and just about that time I believe they were working on polyethylene and wire.

Q. Were those experiments successful in producing a product with which they were satisfied for the purpose? A. No, they were not.

Q. Will you continue then and tell us what happened thereafter? A. Well, they each had a defect. I remember clearly that we were discussing the acetate and cotton and that it couldn't be made to adhere together; and also with polyethylene and wire, where the wire creeps through the polyethylene jacket and pokes out at the end. However, the wire itself seemed a good idea to me. It was very stiff and very flexible. And we then—I should say I then continued with that work and produced a wire coated with nylon.

Q. Was that a satisfactory product? A. It was satisfactory in one way. You could bend it and it would not break off. It had many defects in that the wire crept a little, not quite so much, but it was a bulky (211) boning, and it could not be sewn through.

Q. Was it good enough to be adopted for commercial use, was the company satisfied with it? A. No.

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By Mr. Greene:

Q. What I meant to bring out was simply—when you took that sample to the boss and said, "Here it is," did he put it in production, commercial production? A. No.

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Q. What did you do next? A. On my next answer I would like to say "we" because I was only a party to the next experiment. We were hoping at that time to get better adhesion between the acetate jacket and the center core by having the core manufactured from acetate tape or from rayon tape. And on these experiments we ran into troubles again.

(212) Q. What troubles? A. One of the difficulties is that all fabrics have a small amount of moisture absorbed, which, when the fabric passes through the extrusion die, produces steam, which actually tends to push away the jacket which you are trying to lay around the tape. We tried to overcome that by sucking the steam backwards by means of a vacuum. It was very clumsy and it didn't really work. We tried to dry the tape and we found that even after extensive drying a very small percentage of moisture was still left. We practically had to brown or burn the tapes to get all the moisture out. And even then adhesion between the tape and the acetate was not good.

Q. Was it a satisfactory product for your purposes, or your company's purposes? A. No, it was not.

Q. What did you do next? A. I then felt that we could get better adhesion between nylon and tape, and we proceeded to extrude nylon around various tapes, mostly cotton tapes.

Q. When was this, by the way? A. As far as I remember, that was in late '48 or January '49.

Q. Did everything that you talked about up till now come before that, after that, or in between? A. Before.

(213) Q. All right. And what did you do with respect to the nylon tapes? A. We proceeded to try and make samples in this manner, and we had some difficulty. We couldn't lay the nylon, which is very fluid when hot, properly around the tape. It would tend to drop off to one side.

We definitely got better adhesion between the tape and the nylon. And I don't recall quite clearly, but I think this tape could be sewn, and it would hang together fairly well.

Q. Was it satisfactory as a boning product? A. Well, we couldn't really produce it in quantity, because we constantly had trouble with it. And then when we finally added up what this thing would cost, taking into account the difficulties we would have, and the fact that a braided tape is expensive, and that nylon is nearly four or five times as expensive as some of the acetate materials, we felt that we would have to abandon it because of cost.

Q. Did you do any other experimentations before you came to the invention, the area of the invention? I think this covers a list of your composites, is that correct? A. Yes.

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(214) Q. I hand you herewith Plaintiff's Exhibit 5 for identification and ask if you can say what that is. A. This is regular acetate boning.

Q. Do you know who manufactured that? A. We must have manufactured this ourselves.

Q. Does it correspond substantially, as you see it, to what you have manufactured? A. Yes.

Q. Do you see the holes in there? A. Yes.

Q. Who put those in? A. I did.

Q. How did you put them in? A. I took a regular commercial sewing machine and, with some struggle, managed to perforate the boning.

Q. When did you make this sample? A. A few days ago.

Q. Is this acetate different than the acetate that existed in 1948, so far as you know? A. It is not.

Q. Do you know that the chemical composition then is the same as it is now—or do you know that? A. I do.

(215) Mr. Greene: I would like to put this in evidence. I think it is now marked for identification.

Mr. Churchill: I object to its relevancy, your Honor, to the patent in suit. I have no other objection to it.

Mr. Greene: I think it is fairly obvious that the invention was intended to remedy the defects of this prior art, so I think it is relevant.

The Court: I will allow it.

The Clerk: P-5 formerly marked for identification, now marked in evidence.

(Received and marked Exhibit P-5.)

Mr. Churchill: The fact that they couldn't put holes in it is fairly well understood in the art.

Mr. Greene: And the fact that it breaks easily, that is conceded. There is no use going into that.

If you want to see how it breaks—I don't know if you have ever broken it.

The Court: Is it all right for me to break it?

Mr. Greene: That is what we did it for, for everybody to have a shot at it. A couple of flexes and it is gone.

Q. First tell me then, what was your next work or experimentation, and when? A. In 1949, at the end of January, or early in February, we decided to abandon this approach and we hoped—I (216) should say "I" hoped to modify acetate in some way by adding other plastics to it.

Q. Well, what did you do? A. I prepared a mixture of cellulose acetate and cellulose acetate butyrate molding powder and blended it and ran it through a small lab extruding machine.

Q. When you say "lab extruding machine" is that one that was used for any commercial product? A. No.

Q. Is that where you did your experimentations? A. Initially, yes.

Q. Where was that machine located? A. I didn't get you.

Q. Where was that machine located? A. That was on the fifth floor of our plant in Canal Street, .ay at the back of the other machines.

Q. In New York? A. In New York City.

Q. All right. What was the result of that work? A. This mixture came out fibrous and I was very surprised. I flexed the sample and found that it did not break. And I think I immediately went to Mr. Fisch to show it to him.

Peter H. Seckel, for Plaintiff—Direct

Q. Did you test it in any other ways? A. Well, I think we then showed it to Mr. Dick, who felt that it had merit. I don't know who tried to sew it— (217) it wasn't me—but we found that it could be sewn, and it would still hang together, and a needle would penetrate it, because it does not present such a solid resistance to it. We also found that the ends when sewn into a brassiere, when this brassiere was worn for some time that these ends would break apart and form a kind of wooly structure, which was desirable because it doesn't present a stiff end to the bone.

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Q. Will you just in a little detail explain that statement you just made? A. Well, the end of the bone—

Q. This is Bonar. A. —of Bonar would be sewn into a brassiere, and then this end would tend to flex, of course, as the brassiere is worn. Now, I will do that in a rather short time and try and break the end open. I am doing it now. (Demonstrating) Now it is really breaking open and you will see that it separates into a great number of fibers. Now, when it looks like this in the brassiere, and it is spread apart, it will be a kind of cushioned end and not a solid cut off end as a regular acetate bone would present.

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(218) The Clerk: P-32 for identification, a white (219) brassiere.

(Marked Exhibit P-32 for identification.)

By Mr. Greene:

Q. With respect to that feature of furring out of the end, will you say how that applies or has relevance to the use of the product, Bonar, if it does? I hand you Plaintiff's Exhibit 32 for identification. A. This exhibit shows

on each cup two separate bones which are sewn into the structure. Both bones meet at approximately the same point. I have never worn a brassiere, but I imagine at this point it might be very uncomfortable.

Mr. Churchill: It sounds rather like a speculative answer.

The Court: You mean if it didn't fur it would be very uncomfortable?

The Witness: Yes, sir.

Q. Why?

Mr. Churchill: That is wholly speculative on his part, your Honor.

Q. All right. Not as a wearer, as an observer, can you say what the advantage of having a furred end on Bonar is on that product that you have there? A. Well, at this point the softer, furred end would form a kind of cushion instead of being very hard and sharp.

The Court: You mean that is an unexpected good (220) result?

The Witness: Yes, sir.

Mr. Greene: I offer this P-32 in evidence.

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(221) The Clerk: P-32, formerly marked for identification, now marked in evidence.

(Received and marked Exhibit P-32.)

By Mr. Greene:

Q. When did you make this particular exploration of the materials that resulted in Bonar? A. I gathered when

I joined Anchor Plastics that quite a number of things had been tried. We continued along those lines and didn't get anywhere. I have learned from previous (222) experience, and since, that if you try things which are unusual that you might get commercial results. By way of explanation I would like to say that in England I combined vinyl plastics with synthetic rubber. It had never been tried. The result was excellent. It gave a flexible vinyl plastic which was extremly durable. A great deal of commercial success resulted from that.

The Court: He is just giving that by way of explanation, what caused him to go into experimentation.

Q. Well, was it the basis of your experience, therefore, that you went into this examination of avenues here? A. Yes.

Q. Did you have any particular theory that caused you to use cellulose acetate and cellulose acetate butyrate? A. Well, we had used nylon, we had used polyethylene. Most of them were ruled out because they didn't work. And we came back to cellulose acetate as a base material because it is cheap and it had at least the resilience that was required of boning. I hoped to modify the cellulose acetate in some way by adding butyrate or other plastics.

Q. What other plastics did you actually experiment with, if you did? A. I think we tried quite a number of them. I remember we tried polyethylene as an admixture, and we tried ethyl cellulose.

(223) Q. I have here two bundles. Will you identify them first before I mark them in evidence. A. One of these is cellulose acetate with polyethylene and the other one is cellulose acetate with ethyl cellulose.

Mr. Greene: Will you mark for identification as Plaintiff's Exhibit 33 this cellulose acetate with polyethylene.

(Marked Exhibit P-33 for identification.)

The Clerk: P-34 for identification, cellulose acetate with ethyl cellulose.

(Marked Exhibit P-34 for identification.)

By Mr. Greene:

Q. What is Polythene? A. Polythene is actually the trade-mark of the duPont Company for polyethylene, which is a family of plastics, a kind of plastics, I should say.

Q. Is it a cellulose plastic, synthetic resin? A. No, it is not.

Q. What is it? A. It is an ethylene derivative plastic. It is not made from cellulose.

Q. What is ethyl-cel? A. Ethyl-cel basically is manufactured from cellulose, modified.

Q. Did you make these products yourself, Exhibits (224) P-33 and P-34? A. I don't know whether I actually ran the extruder, but I mixed these raw materials and stood by as they were being extruded.

Q. Do you recall about when these were made? A. It was about the same time.

The Court: As what?

The Witness: As the experiments with acetate and butyrate.

Q. And that was when? A. That was in late January and early February of '49.

The Court: '49?

The Witness: Yes, sir.

Q. Where have these products been since then? A. We had them laying around the office.

Mr. Greene: I would like to offer them in evidence to indicate the related activity of the inventor leading up to the invention.

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(225) The Clerk: P-33 and P-34, formerly marked for identification, now marked in evidence.

(226) (Received and marked Exhibits P-33 and P-34.)

By Mr. Greene:

Q. What is the nature of P-33 and P-34; was that a successful experiment? A. I would say yes, that these experiments were done because we had been successful with acetate and butyrate in producing something new and we were naturally interested in trying other plastics to see what would happen. I am now looking at P-33, which is acetate with polyethylene. It produced fibers, but we discarded it as boning because the material is very soft and it doesn't have the stiffness which we would expect from boning, and it tends to disintegrate too readily, there isn't sufficient adhesion between the fibres we produced here.

The Court: Does that satisfy you, that answer?
Mr. Greene: Yes.

Q. How about the other, P-34? A. P-34 is a mixture of acetate and ethyl cellulose. In a way, this was unsuccessful because we got just the reverse effect. It couldn't be used as a boning because it was too rigid and it didn't split readily when a needle was sewn across it.

Q. Are there other uses possible for these two products, P-33 and P-34? A. Yes. Mr. Dick already mentioned that we are trying (227) to develop a wall plug which makes use of the splitting characteristics of this material when the nail or screw is driven through it.

Q. Did you do any further work with other plastic combinations at this time? A. I am not sure whether we tried others just then. These showed that acetate and butyrate might be better for boning. I believe a few weeks later we tried again, the plastics.

Q. Well, what was your best result, which combination gave you the best result? A. We came to the conclusion then, and it is my firm conviction now, that acetate and butyrate are the best for boning.

Q. I hand you P-6 for identification; will you state what that is? A. P-6 is our regular Bonar, which a few days ago I perforated with a regular sewing machine.

Q. Needle. A. Needle.

Mr. Greene: I want to offer that in evidence. It is regular Bonar with regular needle holes in it.

Mr. Churchill: I have no objection.

The Clerk: P-6, formerly marked for identification, now marked in evidence.

(Received and marked Exhibit P-6.)

By Mr. Greene:

(228) Q. Which did you do first, any particular sequence in these experiments of plastic and plastic, do you recall? A. I don't recall too clearly. I believe that acetate and butyrate were either the first or were certainly done within a few hours of the first material we tried.

Q. And the others took place when? A. Within a few days thereafter.

* * *

Peter H. Seckel, for Plaintiff—Cross

(230) Q. Did you sign an application for the patent on the subject of this Bonar invention? A. Yes.

Q. Yes that application, or the patent resulting therefrom, assigned by you? A. It was assigned to Mr. Fisch.

Q. And do you have any beneficial interest in that patent in the form of a royalty or otherwise? A. I did not at the time. Since then Mr. Fisch is paying me a one per cent royalty on sales.

Q. By sales I gather you mean sales of this product? A. Yes.

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(235) *Cross-examination by Mr. Churchill*:

Q. How old are you, Mr. Steckel? A. I am 30 years old.

Q. In 1940 you were how old? A. 15.

Q. And that is when you started to work for the British Ministry of Supply? A. No, sir; that was in 1942.

Q. When you were 17? A. Yes, sir.

Q. And what did you do for the British Ministry of Supply? A. I was engaged as an assistant chemist and I worked in the inspection department at first, where we inspected, (236) and tested, and, to some extent, developed war supplies. It was mostly in rubber and plastics, but there were other problems of explosives, and soaps, and anything that had to be taken care of.

Q. Where had you studied chemistry prior to taking on this job? A. At high school.

Q. You had had high school chemistry? A. Yes, sir.

Q. What did you take up in high school chemistry?

The Court: What we call elementary chemistry, is that what you took up?

The Witness: Well, it is more than elementary in England, because you go further. I studied organic chemistry and inorganic chemistry.

Q. Basic inorganic chemistry? A. Yes, I would say so.

Q. And basic organic chemistry? A. Yes.

Q. You did not go into the higher chemistries? A. No.

Q. I believe you testified yesterday that you attended college at night for six years, is that correct? A. That's right.

Q. What is that the equivalent of in a day school (237) course? A. It is very hard to say. All I can say is this, that when I came over here, I went to City College and inquired, and they allowed me approximately 65 credits on my English studies, which is probably equivalent to two years of regular day study. I am not too sure, however.

Q. And after you went to City College you did not pursue any chemical courses? A. No, I did not.

Q. So that your academic training in chemistry is high school chemistry and an allowance of the equivalent of two years credit at C. C. N. Y., is that correct? A. Yes.

Q. Do you actually have a degree in chemistry? A. Well, the intermediate B.S. is not a full degree. You can call it a diploma, if you wish. In England, during the war, it was accepted as an academic standing. It is not a good one, I will admit.

Q. Where did you first gain experience or knowledge concerning the extrusion of cellulose acetate? A. I extruded some of it at Stadium Limited in London.

Q. Into strip form? A. Well, it was more like a wide sheet at that time.

Q. Did you also extrude cellulose acetate butyrate at Stadium Limited in London? (238) A. No.

Q. Had you ever extruded cellulose acetate butyrate prior to entering the employ of Anchor Plastics Company? A. No.

Q. So your first experience with extruding cellulose acetate butyrate was at Anchor Plastics Company, is that correct? A. Yes.

Q. Had you ever extruded any other plastics prior to entering the employ of Anchor Plastics? A. Yes, I also extruded vinyl materials at Stadium Limited.

Q. Did you extrude polyvinyl chloride at Stadium Limited? A. Yes.

Q. Into what form? A. That was mostly into tubing for carrying handles on luggage and into binding for luggage.

Q. What was your knowledge in 1948 concerning the fiber forming characteristic of polyvinyl chloride? A. I was not aware of it.

Q. You were unaware that polyvinyl chloride is one of the well known fiber forming compounds? A. Your question assumes that it is now. I do not think it is.

Q. So your testimony is that today, to your knowledge, (239) or your lack of knowledge, that polyvinyl chloride is not a well known fiber forming compound? A. Not in the sense we are talking about here, no.

Q. In the sense of being a fiber forming compound. A. I don't think so.

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(240) Q. When did you start to work on the boning problem? A. Well, I started almost immediately after I joined Anchor Plastics. We tried to make boning, as stated before, in another way.

Q. And as illustrated on one of the exhibits? A. Yes.

Q. Will you please refer to Plaintiff's Exhibit P-8 for identification and tell me which of the types of boning strips there illustrated had already been worked on before you arrived at Anchor Plastics? A. I believe that Anchor Plastics, prior to my joining the company, had gone as far as item 4, which is the polyethylene and wire.

Q. That had already been tried before you reached there? A. Yes.

Q. And then did you participate at all in the polyethylene and wire work? A. Not that I can remember.

Q. Did you participate in the nylon and wire work? A. Yes.

Q. Now, what was the purpose of the wire? (241) A. Wire, first of all, is very stiff and resilient. We used a music wire, which is a spring wire. And, secondly, even if the plastic breaks, it would tend to hold the pieces together. It acts as a reinforcement.

Q. So that you were relying upon the physical nature of the wire itself as something which can be flexed and not break, and you were relying upon the nylon as the plastic material to constitute the main body of the stay, is that correct? A. Not quite. The nylon in itself, of course, also acts as a reinforcing agent. It isn't, therefore, just body.

Q. But the avoidance of breaking through flexing was going to be contributed by the wire, is that correct? A. Not entirely, no.

Q. Well, let me ask you this way then. You were trying to combine physically, to get the physical characteristics of two products, to combine them physically into a stay material, is that correct? A. Yes, sir.

Q. One being wire and the other being nylon. A. Yes.

Q. Then when you moved on to acetate and tapes, did you participate in that experiment? A. Yes.

Q. What was the purpose of the tape? (242) A. Well, there again we hoped to get some kind of reinforcement. The tape is softer and we thought that the needle would penetrate the boning more easily.

Q. The tape was actually fabric, was it not? A. Yes, it was.

Q. So that you were trying to combine again physicaliy a tape with a plastic so that you could have the physical advantage of both, is that correct? A. Yes.

Q. Now, then you moved to nylon and tape, is that correct? A. Yes.

Q. Did you participate in that work? A. Yes.

Q. What type of tape was there sought to be used? A. Well, we had found that cotton or acetate or rayon tapes seemed to behave in a like manner. There wasn't very much difference. I think we just used regular cotton tape in this instance.

Q. Once again you were trying to make a physical combination of a fabric tape with a plastic material, is that correct? A. Yes.

Q. So in all your prior attempts, those in which you participated, you tried to combine physically two materials to provide a tape, or a boning material, which would be (243) capable of flexure and relying upon the insert, be it wire or be it tape, to prevent breaking, is that correct? A. Not quite. It was not only aimed at preventing breakage.

Q. Or to permit flexure? A. I think that would cover it a little better, yes.

Q. When was the work done on the nylon and tape, when was that experiment conducted? A. I would think it was in January of 1949.

Q. Now, the next experiment that you performed which led to Bonar was conducted when? A. That was late in January of '49. I might add here that you can't define these experiments within such close times. We didn't abandon one and try another. Some of them overlapped. We didn't rely on any one approach to solve this problem.

Q. Well, at the time you had experimented with nylon and tape, in January of 1949, the Anchor Plastics Company

had in its plant drums of cellulose acetate and cellulose acetate butyrate, did it not? A. Yes.

Q. And those two plastics were used in daily production, were they not? A. Yes.

Q. Well, then you went to the two drums, one containing (244) cellulose acetate and one containing cellulose acetate butyrate, mixed the two together and gave them to Mr. Rothman, and said, "Extrude these," and he did, and you thereby produced, chemically rather than physically, a material which could be sewn across, is that correct? A. No, it is not.

Q. Well, wherein is that statement wrong? A. First of all, I did not give this mixture to Mr. Rothman. I tried it myself in a lab extruder.

Q. And you found— A. And I found that the mixture looked at first like a solid piece of material.

Q. And you had no reason to expect that it would produce longitudinal fibers? A. Certainly not.

Q. You had no knowledge that longitudinal fibers could be prepared in that fashion? A. No.

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(248) Q. Before you signed your patent application for the patent in suit, did you read it over? A. Yes.

Q. Did you understand it? A. Generally, yes.

Q. Were there any places where you did not understand it? A. Well, it is written in patent language, with which I do not concern myself, normally.

The Court: But generally you understood what was in it, didn't you?

The Witness: Yes, your Honor.

Q. I show you a copy of the patent and ask you, (249) particularly, if you will refer to column 3 on the second

page under the heading of "Example," did you supply the material which is there set forth by way of example? A. To whom?

Q. To the patent attorney who prepared this patent application. That was Mr. Greene's firm, was it not? A. It was Mr. Greene's firm. I am not sure whether I took samples there or not.

Q. Did you supply the information which is set forth here by way of example? A. Yes.

Q. Now, 50 pounds of commercial cellulose acetate molding powder having a particle size of about one eighth inch to one-quarter inch in diameter is actually Tenite 1, is it not? A. It could be, but there are other manufacturers of cellulose acetate.

Q. When you operated according to this example did you use Tenite 1? A. I am not sure. I might have used also a Celanese material or other acetate we had around.

Q. Well, Tenite 1 corresponds to this description, does it not? A. Yes, it does.

Q. And an equal amount—which would be 50 pounds—(250) of commercial cellulose acetate butyrate molding powder of approximately the same particle size, that is Tenite 2, is it not? A. Yes.

Q. The commercial product, Tenite 2? A. Yes.

Q. Then a half pound of a pigment such as titanium dioxide—that's the conventional pigment which is added to color plastic materials white, is it not? A. Yes.

Q. And these two were mixed, or all were mixed, and introduced into the hopper of a continuous extrusion machine—that's the conventional extruder, is that correct? A. No, it is not.

Q. It is the conventional extruder which has been used for years in extruding acetate strip. A. Well, I am not saying no to that part of it. You asked me before whether

all these were mixed. The titanium was not. It was already contained in the initial powder.

Q. So that actually you bought Tenite 1 and Tenite 2 which had the titanium already in it, is that correct? A. That's right.

Q. So you didn't have to practice that step? A. Right.

Q. And then you ran this admixture of Tenite 1 and (251) Tenite 2 already containing the titanium dioxide through the extruder in the conventional fashion and out came this strip, is that correct? A. Yes, after it had been dried, of course.

Q. Yes. And so that in practicing the invention, as here illustrated—and this is the only illustration given of how to practice the invention of this patent—I want to make it clear, I want the witness to make it clear to me that the only example is that if you take Tenite 1 and Tenite 2, mix them together, run them through a well known extruder in the form of strip, and take out the strip, and you have practiced the invention of the patent in suit, is that correct? A. You make it sound simpler, I think, than it really is.

Q. Well, that is your own example given. What else do you do? A. Well, you take care, for instance, in blending the material that it is completely mixed. You did not use the word blending, you just used the word "mixing."

The Court: Well, you don't use the word "blending," either, in your example.

The Witness: I see. Yes, sir.

Q. The example merely says "are mixed with . . ." A. All right, sir.

Q. So that according to your example, you just mixed (252) Tenite 1 and Tenite 2, and run them through an extruder, and you get a strip, and you have practiced the

process of this invention, and you have produced the strip of this invention, is that correct? A. Yes.

Q. And it is that strip which is thus produced which you say can be sewn across? A. Are you talking about the strip in this particular example?

Q. The strip produced in this particular example. A. Yes.

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(257) Q. What did you understand in July, 1949, was meant by the expression "incompatible"? A. That they do not mix.

Q. That two plastics do not mix— A. Yes.

Q. —to form a homogeneous mass, is that correct? A. Yes.

Q. They each retain their separate identity, is that correct? A. Yes.

Q. Prior to January, 1949, did you know of any other (258) plastics, incompatible plastics, which had been admixed? A. Yes.

Q. Which ones? A. As I said before, we mixed vinyl with synthetic rubber, which I know isn't a plastic, but could be considered, I suppose, as an example. And I also knew that Lucite and styrene could be mixed to form a pearl result.

Q. So that you knew in the past incompatible plastics had been admixed? A. Yes.

Q. And the pearl result is obtained in what type of product? A. I have seen it in moldings and in extrusions of plastics.

Q. Now, in molding are you referring to injection molding? A. Yes.

Q. For the production of sheets as distinguished from strips or rods? A. No, injection molding doesn't make sheets, it makes molded articles, usually not sheets.

Peter H. Seckel, for Plaintiff—Cross

Q. And it was prior knowledge, so far as you were concerned, that in molding products it had been known prior to your work on this problem that you could take two incompatible plastics and mix them and you would get a pearlescent effect, is that correct? (259) A. Yes.

Q. What is the pearlescent effect? A. It is little droplets of styrene dispersed in Lucite.

Q. That's where you use styrene and Lucite? A. Yes.

Q. As the two incompatible plastics? A. Yes.

Q. So that effect is actually imparted by the two plastics retaining their separate identities, is it not? A. Yes.

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(265) Q. In your patent, Mr. Seckel, the expression "linearpolymeric" appears. Will you state, please, what you (266) understand by the expression "linear-polymeric"? A. All plastics are made of molecules and molecules themselves are an aggregate of atoms. The plastic —many plastic materials are molecules which are extremely long in length.

Q. And "linear-polymeric" is one which has long molecules, under your definition? A. That is right.

Q. Were you in 1948, or January, 1949, familiar with the fact that many plastics are known to have the characteristic of aligning the fibers longitudinally for thread forming purposes? A. No, I was not.

Q. You were wholly unfamiliar with the fact that there are many plastic materials wherein you can align the fibers to form plastic threads? A. You can align the molecules, but you injected a word "fiber" here.

Q. I meant to say molecules? A. Yes, you can.

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Peter H. Seckel, for Plaintiff—Redirect

(268) *Redirect examination by Mr. Greene:*

Q. You were asked in cross-examination, Mr. Seckel, if the patent discloses anywhere that the material wouldn't break sharply, if broken—

Mr. Greene: The witness has the habit of answering exactly the question and no more.

Q. (Continuing) I want to put it this way to you. Is there anything in the patent here that would teach or indicate the furring or forming cushions at the end of the material? A. Yes, there is a great number of references. There is an illustration of it on the front page, under Figure 21, (269) which is subsequently referred to in the text.

Q. You mean numeral 21. A. Under numeral 21. It is referred to in the text in column 3, line 3. There are other references to show that this material will not break, that it is a thread-like structure. I have marked some of these here.

Q. Will you just refer to them for the record? A. Surely.

Q. Don't read them, just refer to the location. A. In column 1, line 6, there is a description showing that this material had unusual strength and that it could not be torn or broken transversely.

In column 1, line 20, there is a reference to high resistance to breaking as the result of flexing.

In column 2 there is a reference on line 45 to the thread-like structure.

And on line 47 is an explanation of what that strip looks like after it had been flexed and that it does not break.

In column 3 on line 9 there begins an explanation which shows what happens to this strip when it is flexed.

In column 3 on line 18 starts a description of what this strip looks like after it had been repeatedly bent and that the area where it is bent increases, showing that the threads puff out.

In column 4, line 51, is another explanation of what (270) happens to this strip when it is bent—when it is repeatedly bent.

Q. Does that cover it? A. I believe I have one more reference marked.

The Court: Column 4, line 70?

The Witness: Well, your Honor, each claim, I think, actually contains some kind of description.

Mr. Greene: Let's pass that by because we can make reference to these.

Q. When you mixed cellulose acetate and cellulose acetate butyrate in your experiments leading to the making of Bonar, were you aware of any teaching that they could be mixed for any satisfactory purpose? A. No.

Q. Were you aware of any reason why they shouldn't be mixed? A. Well, there were always warnings that they should not be mixed.

Q. Did you expect to get any particular result? A. No, I was simply curious to see what would happen.

Q. Did you expect to get a fibrous structure? A. Certainly not.

Q. Is there anything in the literature or the textbooks that you know of which would indicate that mixing acetate and acetate butyrate would give you that type of structure? (271) A. No.

Mr. Greene: Will you mark this for identification, please?

Peter H. Seckel, for Plaintiff—Redirect

The Clerk: P-36 for identification, lucite and styrene samples.

(Marked Exhibit P-36 for identification.)

Q. I hand you a card which says "Lucite and styrene" on it and ask you to identify it, if you can. A. I recognize it.

Q. What is it? A. It shows in one case, the upper sample, a section of a sheet, presumably, which had been prepared by this means.

Q. What means? A. By mixing styrene and lucite.

Q. Are styrene and lucite compatible or incompatible? A. They are incompatible.

Q. What is the bottom piece on that same card? A. This shows an extrusion which we had actually made ourselves and sold commercially.

Q. From what? A. From a coloring material which we bought, which contains styrene dispersed in lucite.

Q. Why do these pieces have a pearl effect, if they do? A. The styrene forms small, but I think visible, droplets like an emulsion.

(272) Q. Are they incompatible from start to finish, styrene and Lucite? A. Yes.

Q. Is there any fibrous structure in those pieces? A. No.

Q. What would happen if you applied sufficient force, for example, to the rod? A. You would—

Mr. Churchill: That is objected to as asking for an expression of opinion.

Mr. Greene: You are correct.

Q. Have you ever broken this type of material? A. Yes.

Q. What is the effect of that break? A. It breaks with a sharp fracture.

Peter H. Seckel, for Plaintiff—Redirect

Q. Is there any particular schedule of what happens when you mix incompatible materials together, I mean is there any way in your textbooks, literature, or common knowledge, that you can anticipate in any way? A. No, I think you have to take each case by its own merits.

Q. In your direct examination I think that you said that each of these materials retains its separate identity. What is the pearl effect due to here? A. It is due to little droplets of styrene, of pure styrene in that material.

(273) Q. Well, is it optical phenomena or chemical phenomena? A. It is mainly optical, I would say.

Q. Have you ever extruded cellulose acetate and cellulose acetate butyrate in a clear piece? A. Yes, I have.

Q. Is that a transparent piece? A. Completely transparent.

Q. What happens to that on flexing? A. It then separates into fibers, just like Bonar.

Mr. Greene: I want to offer in evidence this card, P-9 for identification.

Mr. Churchill: Well, the card, P-9, your Honor, is the one to illustrate the very wondrous effects of sewing across this material, which are not mentioned in the patent, and I would like to head my objection from the standpoint of relevancy.

The Court: You may have that continuing objection, and there will be the same ruling. If it is shown that it is not relevant, it will be stricken.

The Clerk: P-9, formerly marked for identification, now marked in evidence.

(Received and marked Exhibit P-9.)

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(274) Mr. Greene: I have here P-20 for identification, which is a letter written to Mr. Seckel, dated February 24, 1949.

Peter H. Seckel, for Plaintiff—Redirect

Q. Do you recognize that letter? A. I do.

Q. What was the purpose of that letter? A. It was written to me by Standard Tape & Trimming. In this letter they were—or with this letter they enclosed samples of cloth braid, and I now see also that they referred to—said that they hoped my experiments would be successful.

Q. Do you recall the incident in which you received this letter, at that time? A. Yes.

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(275) The Clerk: P-20, formerly marked for identification, now marked in evidence.

(Received and marked Exhibit P-20.)

Q. I have here P-11, 12 and 13, which represent what? A. They show Featherbone, regular acetate and Bonar in water.

Q. Were these made up by you, or under your direction, (276) these samples? A. They were made by me.

Q. When? A. A few days ago.

Mr. Greene: I offer them in evidence.

Mr. Churchill: I object to them, only on their relevancy, your Honor.

The Court: Mark them.

The Clerk: P-11, 12 and 13, formerly marked for identification, now marked in evidence.

(Received and marked Exhibits P-11, P-12 and P-13.)

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(278) Mr. Greene: If you have it, will you do that, please.

I want to offer that in evidence to show not the invention, but merely the combination of lucite and

styrene, sold in commerce, which is two incompatible plastic materials mixed together, molded together.

Mr. Churchill: No objection for that purpose.

The Clerk: P-36, formerly marked for identification, now marked in evidence.

(Received and marked Exhibit P-36.)

Q. What is this strip that I hold in my hand? A. This is a strip of clear Bonar which we obtained.

Q. Who made that? A. It was made in our plant under the direction of Mr. Rothman.

Q. Were you present or did you help in the manufacture or the direction of the making of this? A. No, we simply told him to—instead of using white material to use clear material.

(279) Q. Does that mean you left out the titanox, the whiting material? A. Yes.

Q. Does this contain cellulose acetate and cellulose acetate butyrate in the proportions cited and made by the method described in your patent in issue here? A. Yes.

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(280) The Clerk: Strip of clear Bonar marked P-37 in evidence.

(Received and marked Exhibit P-37.)

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(282) Mr. Greene: By the way, again trying to shorten the thing, I would like to avoid calling witnesses to show that this Boner material was quickly accepted in the trade and was successful commercially. I think that the defendant is perfectly aware of all the circumstances, since he is in that business, and I ask if the defendant will stipulate that Bonar

was accepted in the trade quickly and was a commercial success.

The Court: Can you do that, sir?

Mr. Churchill: That is a very substantial concession to be asked to make. I will stipulate this, that in 1949, early 1950, on account of the shortage of steel there was a desire on the part of the brassiere and garment trade to get a plastic stay and that when that plastic stay was supplied by Anchor Plastics, and others in the field, to meet that demand, why, that plastic stay was accepted and used by the trade .. 1949 and 1950.

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(287) JOHN M. DeBELL, called and sworn for the plaintiff, testified as follows:

The Clerk: May we have your full name and address, please?

The Witness: John M. DeBell, 100 Crescent Road, Long Meadow, Massachusetts.

Direct examination by Mr. Greene:

Q. What is your occupation, sir? A. Chemical engineer.

Q. What is your experience in the field of chemistry and plastics? A. I was graduated in 1917 from the Massachusetts Institute of Technology as a chemical engineer. After serving two years as an artillery officer I have been in the plastics field since 1922; from 1922 to 1932 in the development and manufacture of phenolic resins and compounds for General Electric Company; from 1932 to 1936 introducing ethyl cellulose in the United States for Hercules Powder Company; from '36 to '39 as Director of Research and Development for Fiberloid Corporation, later

the Plastics Division of Monsanto (288) Chemical Company; a consulting engineer since 1939; consultant during the war for the War Production Board, the Rubber Director and the Quartermaster Corps; author with Mr. Gloor of Hercules Powder Company and Mr. Goggin of Dow Chemical Company of German Plastics Practice, which is a compendium of information compiled for the Army; president of DeBell & Richardson, a consulting and engineering firm in the plastics industry; and chairman of the Connecticut Valley section of the American Chemical Society.

Q. How long have you been associated with thermoplastic extrusion? A. Since 1932.

Q. And in what connection? A. First at Hercules Powder Company in experimental work involving cellulose acetate and ethyl cellulose, later with the Fiberloid Corporation in the extrusion of safety glass plastic from cellulose acetate, and later from vinyl butyral, and later with various extruders of various types.

Q. When did you learn first of the subject matter of the invention here at issue? A. Either late in February or early in March of 1954.

Q. On what occasion was that? A. I was visiting Anchor Plastics on another matter and Mr. Seckel showed me this strip which he was making—

Q. Referring to P-6. (289) A. — and described its composition.

Q. You are referring obviously to a counterpart of that P-6, not P-6 itself? A. I am referring to the product, not this particular strip.

Q. Are you acquainted with the patent No. 2,531,234? A. Yes.

Q. Do you understand this product, its manufacture and its qualities? A. I believe so.

Q. What is your opinion of it? A. I think it is an excellent product and an ingenious invention.

Q. What is your knowledge—

Mr. Churchill: May I interrupt for a moment? I object to the characterization of it being an ingenious invention.

The Court: Yes, "invention" is a legal term that I have to find—whether it is an invention or not. You mean in the colloquial sense.

The Witness: I do, sir.

The Court: Something new, you mean.

The Witness: Yes.

The Court: It won't affect me in my judgment, Mr. Churchill. I realize the way he is using it.

By Mr. Greene:

(290) Q. What is your experience with respect to mixtures of thermoplastic materials? A. Mixtures of incompatible thermoplastic materials have been a nuisance in the plastics industry. Since the earliest types, the manufacturers have warned against mixing the different thermoplastics, the reason being that such mixtures usually resulted in completely deficient products, which might have —in failed products—which might have pimples, or fish-eyes, or shrink irregularly, or age differently, or have different light exposure effects, or, in some cases, even have di-electric troubles.

The Court: Hold that a minute. Di-electric?

The Witness: Di-electric.

The Court: What does that mean?

The Witness: That means that an article which is supposed to have one set of di-electric properties, if some contamination gets in, behaves entirely differently and may be useless.

The Court: What does the word "di-electric" mean?

Mr. Greene: Di-electric, for example, means insulator. An insulator has di-electric properties in the sense that it doesn't allow the passage of electric current or leakage.

The Court: I see.

The Witness: There is a di-electric barrier on (291) this conducting cord. I presume it is an electric cord.

There are some rare but notable exceptions to this where mixtures of incompatible thermoplastics have been found useful. You heard of one this morning in the mixture of vinyl chloride and a type of rubber.

Another is, for example, the mixture of styrene acrylonitrile co-polymer and the hycar type of rubber, which is an acrylonitrile butadiene co-polymer.

Another is the pearlescent composition, which you saw this morning, in which, for example, styrene and—poly styrene and poly methyl methacrylate are mixed. These cases are rare and the exception and in all cases with which I am familiar they have been patented.

Mr. Churchill: That is a characterization again, without mentioning the patent numbers.

The Court: You can cross-examine him to your heart's content on his authority for making that statement. You realize that he holds himself open to that now.

By Mr. Greene:

Q. Are you referring to P-36 in your reference to a lucite and styrene combination? A. P-36 is a pearlescent

mixture which is entirely similar and here described as a mixture of poly methyl methacrylate and poly styrene.

Q. Are those compounds compatible or incompatible? (292) A. The two materials are incompatible.

Q. Are you familiar with the composition exampled there in P-36? A. The general composition?

Q. Yes. A. Yes.

Q. What is the nature of that composition? A. It is a mixture of a certain amount of one of these polymers dispersed in the other. For the best effects of this kind the dispersion is as very small platelets.

Q. Do many plastics mix together well? A. Generally speaking, no. There are some good mixtures. There come to mind, for example, polyvinyl chloride and acrylonitrile rubber, which was used for oleomargarine packages. We have had good results with polymethyl methacrylate and vinyl butyral. However, in some of those cases the plastics are, as nearly as we can tell, miscible rather than immiscible.

Q. Are you acquainted with the various labels presented here on Exhibit P-23? A. While I have seen them before, I have not fixed them in my consciousness until I came into this case.

Q. Do you understand the meaning of the labels? A. Yes.

Q. What is this collection of labels directed to? A. This is directed toward keeping immiscible plastic (293) materials separate.

Q. Have you any experience with any accidental or intentional disregard of those cautions? A. Yes. We have frequently seen instances of contamination over the years of one of these plastics with another, but when that has happened in the past it has always been that the material was ultimately discarded as worthless. I know of no cases before 1949 in which recommendation has been made to

make useful articles out of a mixture from these materials here where the manufacturer warns the user to keep them apart.

Q. By "these materials here" what materials do you mean? A. Tenite 1, Tenite 2, an unidentified combination from Celanese Corporation, which presumably is cellulose acetate.

Q. Without respect to your present knowledge, can you state the state of your knowledge in so far as you know the state of the knowledge in the plastics industry from your experience as a consulting engineer in 1949 with respect to the results that might be expected if you mixed together cellulose acetate and cellulose acetate butyrate? A. In general, the industry avoids it, except for some specific cases, such as I have mentioned, because it means the material has to be scrapped. That means that the fabricator is buying material for 45 to 60 cents a pound and (294) selling it for nothing, for burning it up, ultimately. Obviously, if you do much of that, you go bankrupt.

Q. Could you, as of 1949, as far as your knowledge is concerned, anticipate—or if you could anticipate—what type of structure you would get by the mixture of these two components, Tenite 1 and Tenite 2? A. I would not have liked to prognosticate at that time what you would get if you mixed two immiscible plastics.

Q. Do you keep track of the literature in this field? A. Yes.

Q. How? A. Formerly I read a good deal of it. We keep a current running file of it. At the present time we have one engineer who spends most of his time watching the literature and calls to my attention anything that appears to be noteworthy. As of 1949, or either as of now, I have no knowledge of recommendations of Eastman to mix Tenite 1 and Tenite 2 for useful purposes. I do, of course, know of such a useful purpose here.

Q. Do you know of any other disclosure in any literature, patent or trade publication, or any other method of teaching, that would teach the combination of cellulose acetate and cellulose acetate butyrate for a useful purpose? A. No.

Q. Have you examined the structure, physically, of (295) this Bonar material, P-6? A. Yes.

Q. Will you describe it, please? A. This material is a resilient, longitudinal, white strip, something less than a quarter of an inch wide, and apparently about one-sixteenth of an inch thick, which, when repeatedly flexed, can be flexed without a sharp fracture, and on flexing and twisting to a considerable degree separates into a fibrous structure which still has considerable coherence.

Q. Could this be described as a multi-phase system? A. Yes, from its composition I don't see how it can fail to be a multi-phase system.

Q. How many phases are there actually in this, considering the fact that you know the manufacturing components? A. Well, there are two phases, but those phases probably consist primarily of one phase—of, first, cellulose acetate of plastic grade with plasticizers—that's Tenite 1—and the second phase probably consists primarily of cellulose acetate butyrate and plasticizers, Tenite 2, with some pigment, which is actually a third phase.

Q. Do you know of any other product in which there is a combination of two plastics which arrives at a fibrous structure or a two-phase structure in the same sense? A. No, I would think the nearest thing to it would be extruded Kralastic, which has appeared within the last few (296) years.

Q. And what is that? A. That is a physical mixture of a co-polymer of styrene and acrylonitrile, with another co-polymer of acrylonitrile and butadiene.

Q. Did that appear, as far as you know, before or after 1949? A. I don't know. I should point out, I have never seen it in a form resembling this very closely. I first became acquainted with it about 1952.

Q. What is Neolite, by the way? A. Neolite is a trade name for a mixture of a high styrene butadiene co-polymer with a synthetic rubber of the conventional styrene butadiene composition.

Q. Are the components there compatible or incompatible? A. Incompatible.

Q. What is the nature of the end structure? A. I think I can answer that best by saying it makes a good shoe sole. It is tough, somewhat leathery, not particularly fibrous, but still mainly toward the rubber side.

Q. Does the combination of components here used, cellulose acetate and cellulose acetate butyrate, produce a result that you would expect in your examination of that structure? A. After I had seen it, yes; before I had seen it, no.

Q. Why "yes" afterwards? (297) A. Well, when one sees this structure and knows what it is, everything is very simple and logical.

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(299) Q. You spoke before of the fact that various combinations of incompatibles have been patented. Are you familiar with the specific ones that have been patented and what patents have issued on them? A. The three that I mentioned have been patented, to my knowledge. We have here, either in my case or in some of your files, some of those patents. The patents on the Kralastic type of polymer I know belong to U. S. Rubber Company. I do not have the number here, but I will undertake to furnish numbers. And, likewise, in the third case of the mixtures

of co-polymers, I would have to look up numbers, which I will be glad to do. I know they exist.

Q. Can you, from the knowledge of cellulose acetate itself and cellulose acetate butyrate, and the characteristics of finished products normally made from those individually, forecast the characteristics of this product of their joint (300) usage, which is exampled in P-6? A. I would not so forecast.

Q. What is the characteristic of cellulose acetate, briefly? A. Cellulose acetate—and I presume you mean after having been plasticized?

Q. Yes, and molded. A. And after having been made to an acetylation, which makes a good plastic, is a thermoplastic material which can be extruded at temperatures in the general range of 350 to 400 Fahrenheit, and even wider ranges, which has good toughness, but poor toughness at low temperatures, good water resistance, good color and retention of color. Is that sufficient characterization?

Q. Yes. Does that cover acetate and acetate butyrate? A. Acetate butyrate is a material similar in physical properties but made by combining both acetic acid and butyric acid through the anhydride on the same base cellulose structure and using less plasticizer. This, as a practical matter, means a little less shrinkage over long periods for the acetate butyrate, which partially accounts for the improved steering wheels on automobiles.

Q. Can you say whether the ends of that piece, P-6,—what would happen to those ends if cut and used in a textile product, in closing it? (301) A. If the end is worked it frays out much as is shown in Figure 2 of the Seckel patent.

Q. What causes it to fray out? A. Mechanical working.

Q. Is the flexibility and bend strength of this greater, the same or less than cellulose acetate in and of itself, referring to P-6? A. And in the longitudinal direction.

Q. In the longitudinal direction. A. I would expect that the tensile strength is not much different. In the cross direction, of course, it is much lower. The resilence is better and it does not break with a snap break, or even a clean break.

Mr. Greene: Your Honor, as I understand it, I don't have to apply the specific claims 2 and 7 that we are suing on to the defendant's material, because my understandi- , is the defendant concedes that except for the fact that we don't say "boning material" in the first part of the claim, the claim otherwise reads on their product. That was stipulated.

Mr. Churchill: I go beyond that. I will say that the strip material which we produce in lengths, for whatever use it is applied to, is covered by the two claims of their patent here in suit.

Mr. Greene: That is settled. I don't have to (302) apply the claims.

Q. Can I ask you, as an expert in the plastics art, whether this specific process and product that we speak of here, that we call Bonar, as you know, represents what you believe to be the ordinary advance of the skilled worker in the art making the ordinary hard efforts to get the better product? A. I think this represents a very special advance in the art in that for ten years the consensus of opinion in the plastics industry, so far as I am aware of it, was that mixtures of Tenite 1 and Tenite 2 were useless and had zero value. That is what intrigued me when I learned from Mr. Seckel last year that this mixture which otherwise had been considered useless was now being put to a very good use.

John M. DeBell, for Plaintiff—Cross

Q. Is the concept of mixing these two and extruding them for this result such that on the basis of your technical knowledge of plastics that which you would normally explore in seeking to get a better, stronger plastic stay? A. I would explore it, but I would not forecast the results. I would try it and see.

Q. Does that mean that you would try almost anything you could? A. No, I would pick classes of things that I hoped might work and then see what actually happened when I tried them.

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(303) *Cross-examination by Mr. Churchill:*

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(306) Q. In the plastic art isn't it true that practically all products are homogeneous, intended to be homogeneous? A. I would say the majority of them do.

Q. More than 90 per cent. A. No, because now we get into definitions of what are homogeneous. Do you consider, for example, double oriented styrene as homogeneous or not?

Q. I consider any product which takes on a homogeneity, where it does not laminate, or strip off, or where the plastic materials which go to make it up do not retain their separate identity, as a homogeneous product. A. Well, we have made non-homogeneous products by accident from materials—from single plastics which were supposed to be homogeneous.

Q. That's because some foreign substance got into it, isn't it? A. Not at all.

Q. Then it was an error in molding. A. No, it was not. Well, you can call it an error in molding. The case in mind was ethyl cellulose. It is a well known effect in ethyl cellulose in which without any admixture of anything you can get a laminar structure if you don't (307) pay special attention to your molding or extruding condi-

tions. There are other plastics, single-phase plastics, which give the same trouble to a lesser degree.

Q. Well, you have not had occasion to produce, to meet a customer's desire, a plastic product in the last 20 years wherein you wanted to maintain two separate phases, is that correct? A. Well, strangely enough, we are involved in one right now in which vinyl chloride is such a phase, but the second phase is primarily for the business of coloring or changing the appearance much like this nacreous effect which you see here.

Q. Is that the pearlescent effect? A. It is a modified pearlescent effect, but the object is not pearlescence.

Q. Let me ask you, Mr. DeBell, you heard Mr. Seckel testify this morning that when he admixed clear cellulose acetate and clear cellulose acetate butyrate he was hoping to get a pearlescent effect; as a man skilled in the art, would you so hope?

Answer the question, please. A. Oh, yes.

Q. You would? A. Surely. May I elaborate?

Q. From an extruded strip? (308) A. If I had made that particular mixture I probably would have hoped, if I were looking for a pearlescent effect, to get a pearlescent effect.

Q. Would you expect to get it? A. What I would expect to get was a cloudy effect. What he actually got was neither.

Q. You would not expect to get a pearlescent effect. A. I would expect to get a cloudy effect, in which I am obviously wrong.

Q. Mr. DeBell, do you know anything about fiber orientation, or molecule orientation, in plastic work? A. I have a limited knowledge on that, but not expert knowledge on the preparation of fibers of the nylon and Dacron type.

Q. Do you know anything about the preparation of nylon fibers? A. Yes. You can read it in my book.

John M. DeBell, for Plaintiff—Cross

Q. How are nylon fibers formed? A. Stretched—the essential point to which I think you refer, they are stretched about four times.

Q. I am not referring to stretching. They are formed initially from a plastic material which is extruded through a small orifice, is that not correct? A. Yes. They are formed—that's right.

Q. And in so extruding them thru a small orifice, why, the material being known as fiber forming, the fibers align (309) themselves, or molecules align themselves to make long thread-like fibers, is that correct? A. Not much at the extrusion, but in the subsequent stretching, yes.

Q. They do align themselves at the extrusion, do they not? A. I presume so.

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(311) Q. Have you any knowledge, Mr. DeBell, as to the work done by Dr. Carothers wherein he found that by stretching these fibers which were already thread forming he was able to gain (312) a substantial increase in tensile strength? A. Not only am I familiar with that, but we are doing that right now in our own laboratories. We have run the tensile strength of Dacron up to 9 grams per denier.

Q. So that the stretching was to impart greater strength and not to form the threads themselves? A. The stretching is to orient. A monofil can be formed from almost any plastic—thermoplastic.

Q. A monofilament is a thread formation? A. A monofilament is a thread formation.

Q. Formed by a plastic? A. It may be formed by a plastic.

Q. By extruding through a small orifice, is that correct? A. Or large.

Q. Most of the time it is done by extruding through a small orifice, is it not? A. I am afraid we are getting

into definitions of how small is small. I would characterize the textile fibers as small orifices, the monofilaments, for example, for wrapping wire as rather larger orifices.

Q. Mr. DeBell, in advance of giving your testimony here today did you review a publication cited by the Patent Office during the prosecution for the patent in suit, the publication being entitled Plastics Technology, Stretch Orientation of Polystyrene and its Interesting Results, a paper by (313) James Bailey, which appeared in the May, 1948 issue of the India Rubber World? A. I reviewed it and I also helped prepare it.

Q. Well, now, in reviewing it—and do you have a copy before you? A. No.

Mr. Churchill: This is one of the prior art citations of the Patent Office, which is included in the folder which I supplied to your Honor. So that I am going to have that entire folder marked as an exhibit.

Q. I hand you a copy, sir, and particularly invite your attention to page 229, under the heading Orientation by Extrusion through a cylindrical die. You said you had something to do with helping prepare this paper, I believe, did you not? A. I think you will find an acknowledgment on page 231. Yes.

Q. Would you read that paragraph, please, and then tell me whether that paragraph represents work to which you contributed, or with which you agree? A. "According to the laws of viscous flow * * *" Is that the one?

Q. Yes, please. A. "According to the laws of viscous flow the plastic in contact with the die wall does not move, and the velocity of flow increases toward the center so that a row of dots (314) placed across the line of flow at one instant would be arranged in parabola at a later

instant of time. The shear is a maximum at the wall and drops to zero at the center. Under conditions of steady flow all the molecules would be arranged parallel to the wall, with those nearest the wall stretched the most."

Q. Now, let's stop there. That means, does it not, that all the molecules, being arranged parallel to the wall, would be aligned? A. Provided your entire flow is through an open pipe from the moment of propulsion, from the application of force to the stream.

Q. So that it was known in 1948, in May, and you helped write an article— A. This has been known since Poiseuille described it a hundred years ago, as to the laws of viscous flow, and has no bearing on this that I can presently see.

Q. Will you drop down, please, to the paragraph under that same heading, which starts, "One very high molecular weight * * *" and read that. A. In the same paragraph?

Q. On the same page, the same heading, but down towards the bottom of the page. A. "One very high molecular weight plastic extruded through a quarter inch round die three inches long gave peculiar (315) results. Extrusion under approximately five thousand p.s.i. pressure and at a temperature too low for proper melting gave a material that was fibrous and could be easily picked apart. The fibers lay parallel to the surface and in a longitudinal direction, showing almost perfect orientation."

Q. Let's stop there. Did you have anything to do with writing that? A. No, but I was familiar with the phenomenon.

Q. Now, that phenomenon is that the fibers were not only aligned longitudinally through extrusion, but they could be picked apart, and there was almost perfect orientation? A. That's right.

Q. Now, isn't that fiber forming and thread forming? A. Well, yes, this is polystyrene.

Q. Then you did know in 1948 that it was common practice to— A. This is not a two-phase system at all.

Q. We haven't reached a two-phase system yet. A. I see.

Q. I want to establish first that it was common knowledge prior to the invention of this patent in suit that you could take a fiber forming plastic and run it through an extrusion die and produce a longitudinal thread. A. Sure.

Q. And it was common knowledge that those threads would (316) align and become oriented— A. How did the threads align?

Q. That the molecules would align end to end and become a thread; that was common practice and knowledge. A. I would say so.

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Q. Mr. DeBell, will you please refer to page 229 of the Bailey article again, please, the bottom of the center column. There is a heading reading Peculiar Effects Made Possible by Orientation. A. "It has already been shown that longitudinal orientation makes the material very weak crosswise so that the fibers are easily split apart."

Q. "Let's stop there. Did you participate in that part of this article? A. Yes, in the experimentation backing this article.

Q. And you knew then—May, 1948—that if you had a fiber forming polymer, the fibers being arranged longitudinally, they were a weakened cross section and could be separated apart? A. When they were stretch-oriented, that is correct.

Q. It was a characteristic of the fiber forming polymer. A. No, it was a characteristic of the stretch-orientation.

(317) Q. You say that is solely imparted by stretch? A. Oh, 95 per cent by stretch. It may be a 100, but I don't like to make it too sweeping.

Q. This statement which you have read—they must result from stretch. A. I am saying that in these cases with which I am familiar it did result from stretch.

Q. But are you saying it must result from stretch? A. Oh, I am not—I can't say. No, I don't think I would say it must result from stretch. I cannot think of cases in my experience at this time when it did not result from stretch.

Q. Let's see if we have a common understanding on this article. In fiber formation giving rise to threads, if you take a fiber forming polymer and extrude it through a small orifice, under pressure, do not the fibers—or the molecules align themselves to form longitudinal threads or fibers, without stretch? A. I would say that you get into almost every possible conceivable situation. The tendency when you have straight line viscous flow is to align in the direction of flow. If the viscosity is low enough the immediate tendency thereafter is to disorient. If you pull the fiber when the viscosity is high enough then you get a really good thread.

Q. You increase the thread formation by stretching it, do you not? (318) A. In most cases you produce it. Although a monofil can be made from almost anything, whether it is thread forming or not. It may not have much character.

Q. If you have a non-fiber forming plastic and you extrude through a die, and you stretch it, would you produce a thread? A. You can produce a monofil.

Q. Do you produce a thread? A. And I would not characterize it as a good thread.

Q. All right. So that to produce a thread it was well known that you start with a fiber forming polymer, plastic, is that correct? A. It is well known that you start with a fiber forming polymer. You appreciate, of course, that if that is made into a plastic, it may or may not be a good fiber former after it has been plasticized.

John M. DeBell, for Plaintiff—Cross

Q. I appreciate that, but in order to produce a thread you start with a fiber forming polymer and extrude it through a small orifice, and then if you want to increase the thread tensile strength, you stretch it, is that correct? A. It is correct that you take a fiber former, you extrude it through an orifice, you stretch it, and you produce a thread.

Q. And before you stretch it you already have a thread, but you increase its tensile strength by stretching it, is that not correct? (319) A. Oh, I don't know. You have a monofil.

Q. Well, when you have a monofil you have a thread, do you not? A. Sometimes.

Q. If it is continuously aligned, or oriented, it is a thread, is it not; it may have varying degrees of strength, but it is a thread. A. Well, I would concede that it is a thread. It certainly is a thread, but I am afraid I missed the question.

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Q. In order to produce a thread out of plastic material you must start with a fiber forming plastic, is that correct? A. That would give a much better thread, yes.

Q. That would give you a thread. That's the basis for your start. A. Yes, with a fiber forming plastic you would get a thread.

Q. And you would get a thread, or monofil, merely by running that plastic through an—in extrusion through a small orifice, is that correct? (320) A. I think that is correct.

Q. Then if you wanted to increase its tensile strength, you stretch it? A. Depending on the chemical composition, yes.

Q. Right. Now, prior to 1949 you knew, did you not, that cellulose acetate and cellulose acetate butyrate were incompatible plastics? A. Yes.

Q. And being incompatible, when admixed, they would remain in their separate phases, is that correct? A. Substantially, yes.

Q. Substantially in their separate phases. So that if you mix them to form a sheet of material, that sheet of material would be composed of either laminations, or scales, or other orientation of the separate phases of the two materials, is that correct? A. It would be composed of two phases, yes.

Q. And those phases could be separated one from the other, under certain circumstances? A. I recall no experience in which I have made such structures and separated the phases. It is my opinion that, depending on the molding conditions, they could be separated from each other as, for example, in laminar structure, or they could take a structure much like this pearlescent sample which we have seen, which would not separate easily.

(321) Q. But it is your opinion that if it was a laminated structure they could be separated one from the other? A. Under some conditions, yes.

Q. Now, having in mind that in running—let me say this first. Do you know whether cellulose acetate is a fiber forming plastic? A. Cellulose acetate of a different composition is a well known fiber forming material.

Q. Tenite 1. A. Well, I am thinking of acetate rayon.

Q. Tenite 1 is a fiber forming composition, is it not? A. I would be willing to so define it for this purpose here. I don't think it is much of a fiber.

Q. Is Tenite 2, or cellulose acetate butyrate, a fiber forming material? A. The same as Tenite 1.

Q. The same as Tenite 1. And you knew that prior to 1949? A. Yes.

Q. So that you say you know that Tenite 1 is fiber forming and Tenite 2 is fiber forming, and that they are in

compatible, and hence remain in their separate phases, and that when you run a plastic material which is fiber forming through an extrusion apparatus, and through a small orifice, that gives rise to longitudinal threads, yet you say, do you, that (322) in your position as an expert in this plastic art you would not expect to get longitudinal fibers formed in this strip when you ran the two through, admixed, an extruder; is that your testimony?

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A. I think that is substantially correct.

Q. What would you expect to get? A. As I said earlier, I would expect to get a cloudy, incompatible mixture.

Q. Composed of what? A. Of separate phases of acetate and acetate butyrate.

Q. And how would those phases be arranged? A. Some of them would have started slightly oriented—by that I mean along the line of flow—and they would have promptly disoriented unless they were rather carefully chilled, because the orientation is not ordinarily substantial in an acetate or acetate butyrate plastic. That would be my expectation.

Q. Well, if they were promptly chilled after leaving the extruder, would you then expect to get these longitudinal fibers? A. I would undertake by experimentation to get something of that type. I am not—I can't truthfully say that I would (323) expect to get it.

Q. Would you be surprised if you did get these longitudinal fibers with proper chilling? A. Oh, I don't know.

Q. You would expect to get them, wouldn't you? A. I don't know that I would. I think I could get them by working on it.

Q. That would be a good place to start, wouldn't it? A. For what?

John M. DeBell, for Plaintiff—Cross

Q. To produce a strip made of longitudinal fibers which could be separated one from the other. A. Oh, I would think so. In retrospect I would say definitely.

Q. In foresight, you say perhaps. A. I think in foresight, I would try it and see.

Q. That would be a good place to start— A. Surely.

Q. —if that is what you were looking for. A. I would be very happy—yes, I think so.

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Q. In preparation for your testimony here today did you review a patent to Goessling, which was cited by the Patent (324) Office? A. Is that 2,353,457?

Q. Yes, it is. A. I reviewed it briefly.

Q. Is this a patent which relates to an admixture of two incompatible plastics? A. I think so. May I look at it? Perhaps I have a copy.

Yes, this relates to a mixture of two incompatible thermoplastics.

Q. What two plastics were admixed here? A. Polystyrene and polymethyl methacrylate.

Q. And what type of product was produced? A. A pearlescent—a product which when molded gave a pearlescent material.

Q. Do you know whether either one of those two plastics is fiber forming? A. Oh, yes.

Q. Which one? A. Both of them are in the sense that you can make monofils from both of them. Both of them are not in the sense that they don't crystallize. The styrene threads are the same type of thing referred to in Bailey.

Q. The product here produced is a molded product, is it not? A. I so recall.

(325) Q. Now, in molding, as distinguished from extrusion, is it your knowledge that the fibers or the plastic is just dumped into a mold and permitted to take the shape of a mold without being forced through any orifice?

A. Well, in most molding of thermoplastics the molding is done through an injection machine in which the material is heated in one section of the machine, then forced through a nozzle into a die of some shape or other, and then chilled by the die.

Q. And it takes the shape of the die? A. That's right.

Q. So that in molding the material is distributed at random, is that correct? A. Yes, it is oriented when it comes through the nozzle, to a certain extent there may be a little orientation there, and then it may on chilling be further oriented or disoriented. The net result is usually that there is not much orientation in the molded piece.

Q. So that you get a random arrangement in the mold? A. Yes.

Q. And the product has a random arrangement? A. Yes.

Q. So that where you have two incompatible plastics with this random arrangement that resulted in the pearlescent effect of this patent, is that correct? (326) A. Yes.

Q. Because they were not arranged in any order, they were not aligned in any order. A. You can also do it in extruded rods, as you know.

Q. Now, in the patent which you say you have reviewed, patent to Goessling, which was issued in 1944, the patentee says, on page 2, second column, line 9, "After tests of numerous resin mixtures, I have found the Lucite-styrene mixture to be the best, both as to beauty of pearl appearance and as to strength of structure, but other mixtures have been found to be fully satisfactory. One such mixture is that of Vinylite (vinyl chloride) and styrene. Another such mixture is cellulose acetate butyrate and Vinylite."

John M. DeBell, for Plaintiff—Cross

Has it been your experience, sir, that cellulose acetate butyrate and Vinylite are incompatible plastics? A. I have not personally mixed them, but I think they are.

Q. And if they are incompatible plastics, they would give rise to remaining in separate solid phases, is that correct, when admixed? A. Yes.

Q. And if extruded they would give rise to separate solid phases during the extrusion, is that correct? A. Yes.

Q. Are either one of those fiber forming? A. Yes, to some degree they both are, in the extent again (327) that they will make monofils.

Q. So that both cellulose acetate butyrate and Vinylite are fiber forming plastics and in 1944 Mr. Goessling suggested they could be admixed, even though incompatible, is that correct? A. Surely. That's one of the examples that I was talking about as one of the incompatible jobs which worked.

Q. And being incompatible you would expect them to remain in their separate phases? A. Yes.

Q. So that if you wanted to prepare a product which would have separate phases, extruded or otherwise, you would take two of these incompatible plastics and mix them together, is that correct? A. Yes.

Q. That would be your way of approaching the problem, is that correct? A. As you stated it, yes.

Q. And if you wanted to get longitudinal fibers you would select those plastics which were known to be fiber forming, is that correct? A. I would certainly start with those.

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John M. DeBell, for Plaintiff—Redirect

(334) *Redirect examination by Mr. Greene:*

Q. Referring now to the testimony you gave in answer to questions about Bailey, will you relate what Bailey taught with respect to, or in comparison to, what Mr. Seckel did in Bonar. A. Bailey teaches nothing with regard to Seckel. Bailey worked with a one-phase system, with one material. Seckel was successful only with a two-phase system, with two materials which did not mix. Seckel, when he worked with one material, like Bailey, was unsuccessful. Bailey did most of his work by—of his effective result—by stretch-orienting the plastic after it was formed.

Q. How much stretch did he use? A. Anywhere from 200 to a thousand per cent. Seckel does not so stretch-orient after forming. Now, in particular—

Q. Just one moment. Is it necessary for Seckel to stretch at all? A. No.

Q. In other words, does his result occur by reason of (335) stretch? A. No.

Q. Could Bailey operate without a stretch of at least two or three hundred per cent? A. Not and get his fibrous formation.

Q. What would Bailey have if he didn't stretch at least a couple of hundred per cent? A. A rod of random oriented polystyrene, which would be brittle like polystyrene. He may even get that when he stretches two hundred per cent. He may still disorient so fast that he gets no orientation effect.

The Court: Who is he "he"?

The Witness: Bailey, sir.

The Court: The writer of that article.

The Witness: Yes.

A. (Continuing) We read yesterday an extract from the Bailey article which referred to high molecular weight plastic which could be picked apart into fibers.

The Court: Where does that appear?

The Witness: That is on page 229, the bottom of the first column.

A. (Continuing) Bailey there was extruding at a temperature too low for proper melting. Seckel in no case operates, whether successful or unsuccessful, at a temperature too low for proper melting. So far as I can see, therefore, Bailey (336) teaches nothing as regards Seckel.

Q. Why does the Seckel process produce what is a fibrous strip material? A. I am not fully prepared to answer that question, but will be before this trial ends.

Q. Why? A. Because if you will bear with me and let me point out how the prior art and yesterday's hypothetical discussions bear on Seckel, if at all, I think that will become plain.

Q. Go ahead. A. We also dealt yesterday with a patent to Goessling. That is a dispersion of platelets of one plastic in a matrix of another plastic. The same effect can be obtained by putting in aluminum flake. That teaches nothing on Seckel because in Seckel's, either successful or unsuccessful, attempts he does not make a dispersion of platelets in a plastic matrix, and neither his good samples nor his bad samples that I have seen show any of the pearlescent effect which is characteristic of Goessling.

Q. For purposes of clarity here, when you say a dispersion of platelets in a plastic matrix, do you mean small pieces, whether they be crystals, tiny little plates or drops of one material in a plastic body, which you call a plastic matrix? A. Yes. And they are very tiny.

John M. DeBell, for Plaintiff—Redirect

(337) Q. How tiny? A. I would estimate not over—certainly not over one thousandth long, or wide, and of a very small thickness of the order of magnitude of a wave length of light, which I don't recall. Perhaps Dr. Hasche can help me. The aluminum may be a little thicker than that, but it is a matter of at least ten thousandths, that is, .0001 inches.

Q. Is there any teaching or hint anywhere in Goessling that you could make a strong body, or a flexible body, by a two-phased system? A. No. And I will further state that his method will not, as described, produce a body which is tougher than the plastics which go into it.

Q. Before you pass that, I hand you Exhibit P-36, and ask you what it is? A. P-36 is a pearlescent plastic block, which is labeled as Lucite and styrene, and appears so to be.

Q. What relation has that product got to the Goessling patent? A. This is the product which could be made by the Goessling patent.

Q. Is that similar to Bonar? A. No.

Q. Is there any relationship that is pertinent to the issue here? (338) A. None that I have been able to discover.

Q. Is it flexible? A. No.

Q. Is Tenite I used in making fibers? A. It is not used in making textile fibers.

Q. Celanese is the trade mark for the commonly known cellulose acetate fiber, is that correct? A. Celanese is a trade mark used by the Celanese Corporation of America.

Q. Is it applied to a textile material? A. Yes.

Q. Is the molding powder we are talking about, Tenite I here, used to make that type of material, that fiber material? A. No.

Q. What is the difference between— A. The main difference is two fold. The textile fibers of acetate, that is,

acetate rayon, are a differently acetylated cellulose which does not have any substantial amount of plasticizer mixed with it when it is used in the ordinary textile trade. The molding powder is a lower melting, less acetylated cellulose, which has a very large amount of plasticizer admixed with it, so it can be formed by the plastics industry.

Q. When you extrude cellulose acetate you get a fibrous material? (339) A. Ordinarily when you extrude acetate —when you extrude Tenite 1 you do not get a fibrous material of a textile fibrous type.

Q. You have a sample here, don't you, of what happens when you extrude—P-5? A. Yes.

Q. Is that cellulose acetate? A. I so understand.

Q. Is it fibrous? A. No.

Q. Would it be fibrous under any conditions of extruding that cellulose acetate material? A. Not in the textile fiber sense.

Q. What is the textile fiber sense? A. Textile fiber is a synthetic or natural material of high molecular weight which for some reason has greater strength in the longitudinal direction than in the two lateral directions.

Q. Is that strength induced by stretching? A. In most cases.

Q. To what extent is it stretched, to what extent do they stretch the textile— A. That varies a great deal with different materials and different processes. Four to one is considered enough to orient properly as a general case.

Q. Is four to one the same as 400 percent? (340) A. Yes.

Q. Is cellulose acetate butyrate used to make a fibrous material? A. Not to my knowledge.

Q. Is there any orientation effected in the die in the Seeker process? A. Orientation in the die, as we dis-

cussed it yesterday, does not teach anything in the Seckel process. The Seckel successful and unsuccessful material, both passed through the die, both had the same opportunity for orientation. The sample, P-5, which I understand to be Tenite 1, whatever happened to it in the die is unsuccessful now, breaks off readily and is not the subject matter of Seckel's work, of his patent.

Q. What was the problem that Seckel had in 1949? A. In 1949 Seckel was faced with the problem of producing a stiff, strong, resilient and tough rod.

Q. Was his object to produce any particular structure of rod? A. I am not aware of his mental processes, but as far as the problem was concerned, no.

Q. Would he have been looking for a fibrous material? A. He didn't care, as long as he got the result he wanted.

Q. What happened to the product—I understand that you participated in that Bailey work there—what happened, (341) if you know, to the product that is described there in Bailey, near the bottom of the left-hand column, on page— A. So far as I know, it is still in the archives of Plax.

The Court: What page do you say?

The Witness: Page 229.

Mr. Greene: 229.

A. (Continuing) So far as I know, and I have not seen it lately, it is in the archives of Plax.

Q. Is it a useful product? A. No.

Q. Does it resemble in any way Bonar? A. No.

Q. Is it a two-phase or two-material product? A. No.

Q. Is it stiff, with the strength of Bonar? A. It is stiff, as made.

Q. Is it flexible? A. Not until it is broken to pieces.

John M. DeBell, for Plaintiff—Redirect

Mr. Greene: I would like to offer this strip of butyrate. This is simply a strip of cellulose acetate butyrate and the purpose of our offering it is to show that butyrate in itself is not a fibrous material, it doesn't form a fiber when extruded, no more than acetate does, since what we are trying to establish is the result of what happens when you mix and extrude these two materials.

(342) Mr. Churchill: I have no objection to that strip of butyrate being offered in evidence for what it shows.

The Clerk: P-38, strip of cellulose acetate butyrate.

(Received and marked Exhibit P-38.)

Q. I hand you a strip of cellulose acetate butyrate and ask you to examine that and state whether that is a fibrous material. A. It is not. It breaks on flexing, with a clean fracture.

Q. Does it break similarly—in the appearance of the fracture—to cellulose acetate? A. Yes. To Tenite 1. Excuse me.

Q. Yes, Tenite 1. Is there any reason to believe from either Bailey or Goessling that if you mixed cellulose acetate butyrate and cellulose acetate, namely, Tenite 1 and Tenite 2, that you would come up with a fibrous material? A. No.

Q. Do you know any other teaching in the art, any patent, or any disclosure, or any book, that says if you mix Tenite 1 and Tenite 2 that you will come up with a product that is similar to Benar in its structure and characteristics? A. No.

Q. Does the hypothetical question of whether or not you would use certain materials to form a fibrous material answer the problem before Seckel in '49? A. No, the con-

cept of a fiber forming plastic does not (343) teach Seckel, because if we say that Tenite 1 and Tenite 2 are fiber forming, they are unsuccessful in the extrusion of P-5, Tenite 1 is unsuccessful, Tenite 2 is unsuccessful in the red sample I just had—

Q. P-8. A. (Continuing) —and Bonar is successful. It is clear, therefore, that the whole concept of fiber forming plastic, whatever it may be, does not teach on the Seckel process. It may be good, it may be bad. Fiber forming plastic, so far as I am aware, has still not been defined here.

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(344) Q. Does Goessling teach anything about the problem of making a fiber, in any respect? A. I don't know.

Q. You don't know what? A. Whether he teaches anything that in any respect has a relation to the making of a fiber.

Q. Does he say anything about a fiber? A. That is not the subject matter of his patent and I don't recall that he mentions fiber at all.

The Court: Is that all, Mr. Greene?

Mr. Greene: That is all.

The Witness: May I ask something?

Mr. Greene: Yes.

The Witness: With the further hypothetical questions, may I make one comment on some of yesterday's testimony, sir?

Mr. Greene: Do you want to amplify some statement you made here, or clarify some statement you actually made or is it new material?

The Witness: No, in yesterday's testimony we spoke about molecular orientation.

Mr. Greene: That's right.

The Witness: Now, I think that is going to be (345) important and I therefore raise the ques-

tion. Molecular orientation, likewise, does not teach on Seckel. Molecular orientation has the same opportunity in the useless Seckel Tenite 1 extrusions as it does in Bonar. From observation of the break in Bonar it appears that there is not molecular orientation.

Since—excuse me—from observation of the break in Tenite 1 there is no evidence of molecular orientation. There appears to be none. Since Bonar was formed under the same conditions of temperature, essentially the same conditions of temperature and extrusion, it likewise shows no evidence of molecular orientation.

Furthermore, tests which were made in my laboratory under my direction to see whether it showed evidence of molecular orientation showed no shrinkage when heated to 220, from which I conclude that there is no molecular orientation in Seckel's product, whether good, whether successful, or whether unsuccessful, and that if any orientation ever had been present, molecular orientation, in the die, it was lost before the piece had congealed.

Now, your Honor, if there is any inconsistency between the many hypothetical questions of yesterday, and under the provisos which were put into them, with this testimony, I would respectfully ask that this testimony govern. I am not aware of any inconsistencies.

(346) *By Mr. Greene*:

Q. Is Bailey based on molecular orientation and extension by stretch? A. Yes.

Q. Are those principles involved in any way, any effective way, in the making of Bonar? A. No.

John M. DeBell, for Plaintiff—Recross

Recross examination by Mr. Churchill:

Q. I believe, sir, that you testified that Bailey, the Bailey article, taught that the extrusion should take place at a lower temperature than Mr. Seckel taught, is that correct? A. No.

Q. Did you mention the word "temperature" at all? A. In one case, which we discussed yesterday.

Q. I mean this morning. A. And again this morning. Bailey remarks that he made an extrusion at too low a temperature. That is not at all the subject matter of Bailey's work. That is an isolated rare exception to which he called attention.

Q. Now, you say he worked at a temperature lower than Seckel teaches, is that correct? A. No, he worked at a temperature sufficient to get good melting in the extruder, just the same as Seckel does. Then he took the extrusion, he cooled the extrusion to the lowest possible temperature that he could still stretch without (347) breaking it and then he stretched. That is the Bailey process.

Q. Would you please examine the Seckel patent and tell me where you find Mr. Seckel mentions any temperature at which his product should be produced? A. May I have the copy?

(Handed to the witness.)

The Court: I don't know how good my recollection is, but I have no recollection of temperature being mentioned.

Mr. Churchill: Temperature is not mentioned in the patent at all.

A. I have no recollection, either, of mention of temperature. But from visual examination of the exhibits which I have just had here I know that the temperature was sufficient to completely melt the plastic.

Q. Is that important? A. Definitely.

Q. But it is not mentioned in the patent? A. There are a great many things that are important that are not mentioned in the patent. That is standard art and it is covered by the statement that it is extruded through a die.

Q. Well, didn't Bailey extrude through a die? A. Yes, and he also heated sufficiently, and he also in his—so far as I know, in his patent he doesn't mention die temperatures, but he may.

(348) Q. Bailey was not a patent, it was an article. A. Bailey did take out patents. They are not in evidence here, on this subject.

Q. The prior art publication to which we are referring is an article which appeared in Plastics World Magazine, and is not a patent. A. Well, do you wish me to examine this and see if he mentions the extrusion temperature?

Q. No, it isn't necessary. A. He may. He probably would.

Q. I got the impression on direct examination that you were making the point that Bailey operated at a lesser temperature, and that temperature was important, and Mr. Seckel operated at the right temperature. A. No. I was making the point that the isolated case, which you cited from Bailey, was stated to be below fusion temperature and it is quite obvious that both Bailey, in his main work, and Seckel, in the operation of this process, operated at suitable extrusion temperatures.

Q. Well, Mr. DeBell, this strip, red strip which has been marked as Plaintiff's Exhibit P-38, is that pure cellulose acetate butyrate? A. I don't know whether it is or not. It has been so stated.

Q. You can't tell? A. I am trying to get the butyrate smell. It is probably (349) there but I don't get it.

Mr. Greene: Do you want to take a match to it?

The Witness: Well, should we take the Court's time? Is there a reason for it?

By Mr. Churchill:

Q. Yes.

The Court: Do you doubt that it is?

Mr. Churchill: Your Honor, I submit that is Tenite 2 and not pure cellulose acetate butyrate.

The Witness: Well, I would concede that at once, Tenite 2.

Mr. Greene: Of course it is Tenite 2.

The Witness: And pure acetate butyrate won't handle this way.

By Mr. Churchill:

Q. There is a difference between Tenite 2 and cellulose acetate butyrate, is there not? A. Yes.

Q. What is the difference? A. The Tenite 2 has plasticizer in it.

Q. It already has plasticizer in it. So that this strip that you have here is plasticized cellulose acetate butyrate, is it not? A. Certainly, correct.

Q. And this strip of acetate which has been shown to you, (350) and which has been marked Exhibit P-5, that, too, is extruded Tenite 1, is it not? A. Yes.

Q. And not pure cellulose acetate? A. That's right.

Q. And the difference is that there was a plasticizer included in the molding composition put there by the Tennessee Eastman Company. A. I think I have already so testified.

Q. Well, now, let me ask you this, sir, is cellulose acetate, as such, without a plasticizer, used for making threads or fibers? A. A different grade acetylation is.

Q. Well, cellulose rayon is composed of the fibers formed by cellulose acetate, is it not? A. My belief is that that cellulose acetate is not used in plastics. There are—

Q. I didn't mention plastics at that point, I asked you the question that cellulose acetate, as such, is a fiber forming composition, is it not? A. Yes.

Q. Cellulose acetate butyrate, as such, is a fiber forming composition, is it not? A. I think so, I don't know.

Q. I think you said also that you did not understand (351) the expression "fiber forming," is that correct? A. Fiber forming plastic, so far as I know, has not been defined here.

Q. As a man skilled in the art, when I read from claim 1 of the patent in suit, "A process for producing a strip material which comprises the steps of mixing two non-compatible fiber forming linear polymeric thermoplastic materials," does that mean anything to you? A. I would accept it. I would think that Tenite 1 and Tenite 2 fall rather—while they may or may not fall into that, fall rather under the second claim.

Q. You do not consider that Tenite 1 and Tenite 2 are fiber forming linear polymeric thermoplastic materials? A. I should like to define that in this way. In this claim "fiber forming" is evidently used in the sense of a material which can be extruded from a die and pulled down to a monofil. "Fiber forming" is, however, also used in the sense that a material will make a suitable textile fiber. I am not aware, in the hypothetical questions that were asked yesterday, whether you were referring to something which will make a monofil, but has no significance as a textile fiber, or the higher grade material which will make a true textile fiber, and may—or, further, whether it has a crystalline x-ray pattern.

Q. Well, now, what do you understand by the expression (352) "fiber forming linear polymeric thermo-

plastic materials" as claimed in claim 1 of the patent in suit, what products, or what composition comes within that definition? A. I would there understand any thermoplastic which can be drawn down to a monofil, regardless of whether it has any value as a fiber or not.

Q. If it can be drawn down to a monofil, which means that the molecules will be longitudinally oriented, is that correct? A. No, not necessarily. It all depends on the temperatures and conditions of extrusion. If you extrude the monofil—it has to be extruded hot, let us assume that it is extruded hot—if you now stretch it at that temperature you will still have random orientation. If you drop the temperature and stretch it, you may or may not have orientation.

Q. Is polymerized methyl methacrylate a material which is fiber forming? A. In the sense of claim 1, yes.

Q. So that under claim 1 we could admix methyl-methacrylate and something else, such as styrene, and get the same result? A. As what?

Q. As the B nar material. A. No.

Q. Why not? A. That is an excellent question which I am trying to resolve, (353) your Honor. I cant say precisely why Bonar works. I think—I think that I know the answer. I will try to have it for you and for Mr. Churchill, as to precisely why Bonar works. To Mr. Churchill's question the answer is no, that mixture won't work like Bonar. But I think that we may be able to find out the rule sufficiently so that we would know how to change those materials so they would work. As now on the market, no.

Q. So that it is your testimony, on the one hand, that methyl methacrylate is a fiber forming thermoplastic material—A. That's right, in the monofil sense.

Q. In the sense of claim 1 of this patent? A. Yes.

Q. And if it is admixed with the non-compatible other fiber forming material of styrene, and operated according to claim 1 of this patent, you would not produce the strip called for by this patent, is that correct? A. Probably not; about 499 chances out of 500, not.

Q. Do you know whether polyvinyl chloride would be a fiber forming plastic? A. In the sense of this claim, and of monofils, yes.

Q. So that in the sense of claim 1 of the patent here in suit polyvinyl chloride would be a fiber forming—A. Yes.

Q. —linear polymeric thermoplastic material? (354) A. Yes.

Q. Do you know the commercial or popular name for methyl methacrylate, the trade name, the duPont trade name? A. duPont first—Lucite.

Q. It is the well known substance Lucite? A. Yes. Plexiglas for Rohm & Haas.

Q. In the sense of claim 1 of the patent in suit, what other fiber forming linear polymeric thermoplastic materials can you mention in addition to methyl methacrylate, polyvinyl chloride, acetate, cellulose acetate, cellulose acetate butyrate? A. Ethyl cellulose, nylon, Dacron, Kel-F, polyfluorovinyl chloride—almost every thermoplastic which is solid, not rubbery at room temperatures and slightly above.

Q. So that in the sense of claim 1 you say that cellulose acetate is fiber forming? A. When I spoke of cellulose acetate here I meant Tenite 1 and Tenite 2, and in the sense of claim 1 it is fiber forming.

The Court: Without the plasticizer it is not fiber forming, is that right?

The Witness: It will make a monofil, your Honor, and in that sense it is fiber forming. I don't consider it fiber forming, but that is the sense in which it ap-

pears in this patent. I don't think it enters into this case at all.

(355) The Court: A monofil is like a thread, isn't it?

The Witness: It is like a toothbrush bristle. It is a sort of a large thread which may or may not have much quality. A thread you can usually put a knot in, and pull it. A monofil, usually—except a toothbrush bristle—monofils usually—horse hairs, so-called—when you put a knot in it and pull it, it will probably break. It is all right as a filler material, but it has no textile value.

By Mr. Churchill:

Q. Well, it has less tensile strength than those which are formed by stretching, also, isn't that correct? A. Yes, Mr. Churchill.

Q. The stretching does impart greater tensile strength to a monofil? A. In most cases. Now, whether it will do it with Tenite 1 or 2, I doubt. They are so far removed from orientation capabilities in that form.

Q. Have you separated a strip of Bonar material into its components? A. No, not beyond thumbing it, the way you are doing now.

Q. How much tensile strength is in that thread? (356) (Demonstrating) It broke rather easily. A. Yes, it did. I really haven't any idea, in p.s.i., how much the tensile strength is, and I wonder whether it is significant, because what I am probably doing is breaking a number of very tiny pieces of plastic in rapid succession, rather than pulling one thing at once.

Q. Well, that strip of Bonar is supposed to be composed of a plurality— A. Of filaments, bottom of column 3.

Q. —of individual fibrils—

The Court: Why don't you tell him where you are reading from?

Mr. Churchill: I am looking at claim 7.

The Witness: Yes, I see it.

Q. —supposed to be composed of individual fibrils of each of said cellulose derivatives being arranged parallel, and the strip having a substantial thickness whereby when the strip is bent sharply at any point the phases separate into a plurality of layers each containing a multiplicity of filaments, said product being substantially unseparable transversely thereof by any operation involving only the repeated bending of the strip.

Now, this strip then consists of a plurality of threads, does it not? A. I don't think so.

(357) Q. Monofils. A. Well, that is acceptable. Fibrils we would have to define.

Q. Does the expression "fibril" mean anything to you as a man skilled in this art? A. It means to me something which looks superficially like a fiber.

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(358) Mr. Greene: I have nothing more with Mr. DeBell.

It is clear that the difference between the word "fiber" and "fibrous" is that a fiber is a small thing like that cellulose acetate, it is a strip like a piece of ice—a fiber is an element like a piece of ice, like that strip you could break. Fibrous means a rope, a collection of many, many individual things which together are strong.

The Court: A collection of fibers.

Mr. Greene: Right, fibrous. The rope is a collection of fibers, a collection of individual fibers, it is not fibrous.

The Court: Is that the definition of "fiber" and "fibrous," or do I have to go to a scientific dictionary? Is that your understanding?

Mr. Greene: That is the issue. It is a confusing thing. A rope is fibrous because it is made up of fibers. A fiber could be a small size, like the acetate—not made up of fibers, but an element, like a piece of ice, in the sense that it is not made up of individual ropes inside of it.

Mr. Churchill: Mr. Greene seems to be getting down to the very fine points, because, in any regard, there are a great many individual, very thin pieces and when they are put together they make a thread.

(359) The Court: What are those small pieces called?

Mr. Churchill: Filaments.

Mr. Greene: What is a fiber?

Mr. Churchill: Well, I think Dr. Hasche's understanding is—

Dr. Hasche: A fiber is composed of filaments.

Mr. Greene: Is what?

Dr. Hasche: Composed of filaments.

Mr. Greene: Then a fiber is a small rope made up of filaments. That is what I understand. That is why I raise this point. I thought a fiber or a filament is the beginning where you start. Fiber makes up a rope, a bunch of fibers, but if a fiber is really a rope in itself, then we are not talking the same language. That is why I raise the point.

The Court: We better agree on what you are talking about.

Mr. Greene: I think so, too. What is a fiber, is it a composite or a single element?

Dr. Hasche: A fiber in the art is a certain kind of textile, such as nylon, that is a fiber, Dacron is a

fiber—depending upon what art you are talking about.

Mr. Greene: There it is referred to as synthetic fibers, to distinguish from natural fibers as found in nature, such as wool fibers, or cotton fibers, or silk fibers; and in (360) the plastic art they are synthetic, prepared from chemicals.

What I say is this, when you squirt the liquid out of a hole, you make a filament—if it is big, it is a monofil—you make a fiber. If you put either the filaments or the fibers together you make a fibrous material.

But we don't agree at all that a fiber is more than a single element. And that is the point that I am still confused on, because they say that a fiber is a composite. Dr. Hasche, do they extrude a fiber, or do they extrude the elements which are made into the fibrous whole?

Dr. Hasche: They extrude the filaments that are twisted into a—

Mr. Greene: Right. All right. So you understand that the word "fiber" or the word "filament", that is what is squirted out, you put a bunch of them together, and call it a rope. But they don't squirt out a rope, they squirt out one at a time.

The Court: Yes.

Mr. Greene: Is that right, they don't squirt out a rope?

Dr. Hasche: No, a spinerette may have—

Mr. Greene: Yes, a bunch of individual holes.

Dr. Hasche: That's right.

Mr. Greene: But they don't squirt out a rope ready made.

(361) Dr. Hasche: No, it is twisted.

Mr. Churchill: But it doesn't squirt out a hundred such simultaneously.

Mr. Greene: Side by side.

Mr. Churchill: That's right.

Mr. Greene: That's correct. But each one of those I regard, and my expert regards, as a fiber, or a filament. Put them together, they are fibrous.

And if they don't think so, let them say, because that is my understanding.

The Court: Well, if there is a difference, you will both give your understanding, and then I will decide what it is. That is what they do when experts clash. The Judge, who is not an expert, decides which one he thinks is right.

Mr. Greene: Well, it sounded for a while like they were squirting out a rope, ready made. And it doesn't happen that way.

The Court: I didn't understand that it came out ready made.

Mr. Churchill: No.

Mr. Greene: Well, they don't make a fibrous material by a single extrusion.

All right. I have only one thing to add. That is what we talked about yesterday.

(362) Mr. Churchill: Well, it can be made, as Bailey describes it, making a fiber by a single extrusion.

Mr. Greene: If you then stretch it, pull it, and separate it into something else.

Mr. Churchill: You don't separate it by pulling it, you just elongate it to a thinner filament. And one of the phenomena well known in the art is that by stretching you impart greater tensile strength to it. That has been very clearly brought out in Bailey. That's a phenomenon. It was dis-

covered and very usefully applied by Dr. Carothers in his nylon work, which long anticipates Bailey or Mr. Seckel. You get these nylon threads by forcing out the basic material through a very small orifice, and spinning it, and stretching it, and you get nylon thread.

The Court: Well, if there is any difference between the parties as to the particular significance of the word "fiber" and "fibrous", the plaintiff gives his version of it, and the defendant gives his, and I decide.

Mr. Greene: That's the subject of the testimony he is giving. I am talking about the definition of the word. What Carothers or anybody else does is one thing. I am simply saying that our understanding of the word—giving our understanding of the word "fiber", which is the same thing as "filament."

(363) The Court: All right. Let your understanding be on the record.

Mr. Greene: That's all.

The Court: If Mr. Churchill thinks otherwise, he will put someone on who will give their understanding.

Mr. Greene: And prove it, that's right.

The Court: Does the plaintiff rest?

Mr. Greene: I have this—if called, the following people would testify—

The Court: Yes.

Mr. Greene: If called the Gluckin Corporation of 565 Fifth Avenue, New York City, would testify that Bonar, the product, was sampled to them in February, 1949, and between 1949 and 1952 they bought one and a half million feet of Bonar.

Mr. Churchill: For what purpose?

Colloquy

Mr. Greene: They are brassiere manufacturers. As brassiere stays, I guess.

Rubin Honig of 580 Eighth Avenue, New York, if called, would testify that Bonar was sampled to him in February, 1949, and from '49 to 1952 he bought from Anchor Plastics Corporation and sold three and six-tenths million feet for resale to dress manufacturers.

Mr. Churchill: For what purpose?

Mr. Greene: Strapless evening gowns, evening dresses, primarily.

(364) William Gluckin of 125 Madison Avenue, New York City, if called would testify that Bonar was sampled to him in 1949, in February, and that from 1949 to 1951 he bought and used three million feet for brassieres.

The Mercury Notion Company, 237 West 39th Street, New York, if called would testify that Bonar was sampled to them in February, 1949, by Anchor Plastics Company, and from 1949 to 1951 they bought and used a million and a half feet for resale to dress manufacturers.

Loveable Brassiere Company of 180 Madison Avenue, New York, if called, would testify that Bonar was sampled to them in 1949, in February, and from 1949 to 1952 they bought and used for brassieres twelve and a half million feet.

That is our stipulation. Would you like to have the name of any one of the people who would so testify here?

Mr. Churchill: I would like to know who in the corporation would so testify.

Mr. Greene: In the case of the Gluckin Corporation, Edward Gluckin. In the case of Rubin

Honig, Miss Tillie Honig. In the case of William Gluckin, Saul Kend. In the case of Mercury Notion Company, Irving Berniker. In the case of Loveable Brassiere Company, Ira Linder.

For commercial reasons, we don't have figures beyond 1952, since we think the first couple of years will show the reception and acceptance.

(365) The Court: But you are still selling, aren't you?

Mr. Greene: Oh, yes.

The Court: I notice the cut off date, '51-'52.

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(366) FRANKLIN DICK, recalled as a witness by the plaintiff, having been previously duly sworn, testified as follows:

Direct examination by Mr. Greene:

Q. In 1949 to '51 what was the situation with respect to the supply of the various boning materials? A. There was ample supply of all materials, including specifically steel.

Q. Was steel restricted as a stay material by any government regulation? A. I am not aware of that, sir.

Q. Was there any shortage or difficulty in obtaining steel stays in the market, if you know? A. The brassiere people whom I called upon told me there was no shortage. I have had occasion to speak to salesmen who sold steel stays and they were actively soliciting business all during that time.

Q. From what companies? A. The same people I was calling upon, the brassiere manufacturers.

Q. I know. Who sold the steel stays? A. The salesmen for Durable Supply also represent Diamond (367) Boning, and they sell steel stays. I have also spoken to

a gentleman whose name I can't recall from Wallenstein Industrial Corporation, who are manufacturers of steel stays, and they have never—as they tell me, have never been in short supply or unable to deliver promptly.

Q. What is the price of steel stays by the pound? A. I don't know. They have never been placed by the pound to the foundation people. They are placed by the gross pieces cut to specification size.

Q. How much is that? A. I can't give you—except I can give you this answer, they have always been either directly comparable with our Bonar material, or a trifle cheaper. As of today they are, I believe, as much as ten per cent lower in price.

Q. Steel stays. A. Yes, sir.

Q. Was this cellulose acetate in short supply for boning material? A. No, sir.

Q. Was there any difficulty in a customer getting cellulose acetate boning stays in the period '49 to '52? A. No, sir.

Q. Any signs of a shortage in any direction in that material? A. No, I don't recall any, sir.

(368) Mr. Greene: Cross-examination.

Cross-examination by Mr. Churchill:

Q. Do you have any knowledge of the regulations that were issued by the government in June, 1950, as to the uses which could be made of steel during the Korean Police conflict? A. No, sir; I don't.

Q. So that your testimony is without knowledge as to those regulations? A. Yes, sir.

Q. Is steel still used today? A. Yes, sir.

Q. In what percentage, as compared to plastic stays? A. I don't know, sir.

R. Leonard Hasche, for Defendant—Direct

Q. A very substantial amount of steel still used today? A. Yes, I'd say that.

Mr. Churchill: That is all, your Honor.

The Court: That is all, Mr. Dick.

(Witness excused.)

The Court: Does the plaintiff rest?

Mr. Greene: Yes. I gather that my stipulation was agreed to, that I read into the record. I read—if called they would testify. And that is actually a stipulation which I understand is agreed to.

Mr. Churchill: I have no objection to that statement (369) as to what they would testify to, if called.

The Court: All right. The plaintiff rests.

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(373) R. LEONARD HASCHE, called and sworn for the defendant, testified as follows:

The Clerk: May we have your full name and address, please, sir?

The Witness: R. Leonard Hasche, 1107 Southwest Avenue, Johnson City, Tennessee.

Direct examination by Mr. Churchill:

Q. What is your academic and practical background, Dr. (374) Hasche, in the area of plastics? A. I attended Tarki College, Tarki, Missouri, 1914 to 1918, and received a Bachelor of Science Degree, specializing in chemistry.

The following summer I was inducted into service in World War I and was transferred to the Chemical Warfare Service, where I did considerable work in plastics for gas masks.

At the end of that year—I was discharged in December, and attended Washington & Jefferson College in Washington, Pennsylvania, where I received a Master of Science Degree in June of 1919.

The next three years I taught chemistry, organic and general chemistry, at Carnegie Tech. Then I entered Johns Hopkins University and did work for my Doctor's Degree, receiving that in 1924.

I was then awarded a Fellowship by the National Research Council of the Rockefeller Foundation, going to the University of California, where I spent one year in physical chemical research.

The following year I was awarded a Fellowship by International Education Board, going to the University of Berlin, working under Fritz Haber and Polanyi. I did work there nine months on the physical chemical problem, on phases of combustion.

In the spring of that year I went to the University (375) of Vienna and did work on Atomic disintegration. And the following summer I was sent to Cambridge University in England, doing work with Sir Ernest Rutherford on the same subject.

Returning from Europe, I had intended to teach, I found that the profession was pretty well filled, and I took a position in industry with American Smelting & Refining Company. This was in the summer—no, in the Fall of 1926. I entered the research department and became a director of research in 1929.

In 1931 I went to the A. O. Smith Corporation, Milwaukee, which was organizing a very large department on organic—production of organic compounds, and in connection with a big steel program, using natural gas for steel blast furnaces. I became director of research in that corporation in 1933.

R. Leonard Hasche, for Defendant—Direct

In 1934 I went to the Tennessee-Eastman Corporation as director of research and was in that position until 1943, when I was a dollar a year man in the War Production Board as a consultant in plastics and chemicals.

During my entire period in Tennessee Eastman, as director of research, we worked on plastics for film, for fibers and for yarns, for cellulose acetate yarns.

I might go back a moment. During the employment in A. O. Smith Corporation we did a great deal of work in (376) plastics in a program to make fabricated houses, extruding very large panels of thermoplastic materials. At the same place we carried out development in making plastic table tops for taverns and hotels.

Now, going back to the experience in Eastman Kodak, in 1943, I was made scientific counsel for Tennessee-Eastman Corporation and commissioned to be the liaison man between Eastman Kodak and Tennessee Eastman on development of plastics for film.

At that time, of course, nylon was very—had come to the fore and we were very anxious to at least be equal to the other people, duPont and others, in developments of film.

I stayed in the position of scientific counsel until 1952, January, when I took early retirement from Eastman and took over my own business in the exploitation of my patents and formed the Hasche Engineering Corporation and the Formco Corporation, which is now engaged in selling furnaces for producing gas for utilities throughout the country.

Q. So you left the employ of Tennessee Eastman Company in what year? A. In January of 1952.

Q. When you entered the employ of Tennessee Eastman Corporation—in 1934, I think you said— (377) A. That's right.

Q. —what plastic material was Tennessee Eastman Corporation producing at that time? A. At that time they were producing cellulose acetate, and they were producing cellulose proprionate. Cellulose proprionate was used for amateur safety film. Cellulose acetate was used, as we have heard in this suit, as a plastic, and in—just about the time that I arrived there they were selling the material and I think they started to advertise it about 1933.

Q. Started to advertise cellulose acetate? A. Cellulose acetate.

Q. As a molding— A. As a molding material.

Q. What were some of the uses made of cellulose acetate in 1934? A. By Eastman?

Q. By the people to whom Eastman supplied it? A. Well, it was used in general molding. One of their biggest use was in steering wheels. I think that was probably the largest use. And, of course, every other type of molding, mostly injection molding.

Q. Did you publish a book, Dr. Hasche,—did you write a book entitled "Chemical Engineering Series, (378) Plastics, Theory and Practice"? A. Yes. This book was—I was a co-author of this book with Professor Charles C. Winding of Cornell University.

Q. When was that book published? A. I think it was in '47. Yes, 1947.

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(380) Q. In your capacity as director of research for the Tennessee Eastman Corporation with what problems were you chiefly concerned? A. Eastman Kodak was interested in all types of polymeric materials for the uses—three uses which I mentioned, for film, for plastics, and for synthetic fibers. Originally Tennessee Eastman was bought by Eastman Kodak mainly for the purpose of supplying film material, but gradually Tennessee East-

man became a big chemical company, and they became one—I think they were the largest acetate rayon producer for a long while. There are two others, but they were—they not only produced the continuous, but the staple fiber. They were vitally interested, however, in all new developments of resin, particularly for film, and they wanted to be sure that, as I said before, their competitors didn't come out with one better or ahead of them. And, as a result, our research was directed in the early years to exploring all possible forms of polymers. We took all the monomers that we knew of and made charts—a vertical column of monomers, and across the same monomers, and made all combinations of those by what we call co-polymerization. I don't think co-polymerization has been brought out before.

The Court: That is the first we have heard of (381) that.

A. (Continuing) That's where you take two monomers and polymerize them together, so when you have a chain you may have alternate units of these two polymers. And of course, the main value of those co-polymers is that you are internally plasticizing the material. At best—I think Mr. DeBell will agree with me as an expert—that a plasticizer is a compromise, it gives properties that the material itself lacks, and by co-polymerization you get that all in one unit, the compromise of the properties of the two materials.

So in carrying out this work we made something over 200 different co-polymers and we tested them in the molding machines, in extrusion molding machines. And sometimes when we tried to co-polymerize two things together, they didn't hook up alternately, but they polymerized heterogeneously, that is, apparently it looked clear, it looked like a unit phase, but when we put it through an extrusion machine we found this same phenomena that is disclosed

in this patent, of two different polymeric materials. We had this fibrous structure time and time again. So that we always—whenever we found that we said we didn't have a co-polymer, we had two different materials.

And this phenomenon is also found when we mix plasticizers with a certain polymer, and if we had put— (382) mixed the plasticizer with a polymer on the rolls, granulated it and put it through an extrusion machine, we would get this striated structure, which indicated that we had a non-solvent plasticizer, a similar phenomenon to what we note—as disclosed in the Seckel patent.

Q. When did Tennessee Eastman first put out cellulose acetate butyrate, do you know? A. Cellulose acetate butyrate I think was put on the market commercially around 1938. However, when I went to Eastman it was being developed and test samples had been put out before.

Q. What sort of tests did you run on cellulose acetate butyrate at Tennessee Eastman Corporation? A. Well, acetate butyrate was considered superior in many ways to acetate itself. Cellulose acetate requires considerable plasticizer, up to, say, 50 per cent plasticizer, in some cases, to get soft flows, and the more plasticizer you put in a plastic the more tendency you would have to lose that plasticizer in time and for the material to get brittle. So it was of advantage to get a plastic that requires less plasticizer to give it the flow characteristics. And Tenite 2 was that type of material, we found, that we needed much less plasticizer, ten or fifteen per cent in many cases was sufficient to give us a very good plastic.

(383) Q. You referred to Tenite 2. What is Tenite 2? A. Tenite 2 is a so-called mixed ester, in which—in the cellulose molecule itself—cellulose has three groups that can add an acid, either acetic or butyric. A mixed ester is one in which you have some of those groups taken by, say, acetic acid and you form the acetate ester, part

of it forms the acetate and then some of the other groups may combine with butyrate. So you have what we call acetate butyrate, a mixed ester. In other words, it is a chemical entity, but there are two different groups in the cellulose molecule.

Q. Now, does Tenite 2, as such, contain any plasticizer? A. Yes.

Q. So that when Tenite 2 is marketed, or was marketed by Tennessee Eastman Corporation, it contained the cellulose acetate butyrate plus a plasticizer, is that correct? A. Yes.

Q. Is Tenite 1 a product which also contains a plasticizer? A. Yes.

Q. And what is Tenite 1? A. Tenite 1 is an ester of cellulose which is modified to some extent, it is partially hydrolized, in which some of the acetate groups are removed. This makes it more of a (384) plasticizer, a lower melting point.

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(388) Q. Are you familiar with the warning notices which have been put in evidence as having been put out by the Tennessee Eastman Corporation, as shown on Plaintiff's Exhibit P-23? A. Yes, I am.

Q. Do you recall the reason for those notices being put on the containers of Tenite 1 and Tenite 2? A. Yes, that was to prevent them being mixed, because they were incompatible and did not produce a satisfactory molding or extruded product.

Q. When you say "did not produce a satisfactory molded or extruded product" what is the standard of satisfaction which you are setting up? A. Well, in making a molded object, such as a steering wheel, or making an extruded material, such as a tube or a large rod, it was not homogeneous.

Q. So that in those types of products you want to have a homogeneous plastic? A. That is right.

Q. So that the warning was to convey this knowledge to the molders? A. That's right.

(389) Q. That the product—rather, the Tenite 1 and Tenite 2 should not be admixed if they wanted to get a homogeneous product? A. That's right.

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Q. What is the limitation on what you can use in the way of reground material? Suppose you had several plasties mixed together in your reject drum, would that be usable? A. Well, it all depends on the proportions, yes. A very (390) small amount might be tolerated, but the practice is always to keep them separate. I remember very early when the material came back, the acetate butyrate, they weren't able to identify one from the other, had to throw it away. So that is why this warning started.

Q. This warning was to the molders— A. Yes.

Q. —not to mix the two? A. Yes.

Q. If they did mix the two, what would they be expected to get, of your knowledge? A. Well, if they mixed the two they would get a product that was not homogeneous, poor strength and not usable.

Q. If it was sheet, it would take on the shape of laminations, would it? A. Yes.

Q. And if it was extruded strip, what would be its nature? A. Extruded in strip of comparatively small diameter, we would have this fibrous type of material that we have been discussing, in the Seckel patent.

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(391) Q. What is your understanding, Dr. Hasche, of the expression "incompatible plastics or polymers"? A. Incompatible, as I understand it, is the inability to mix in a single phase.

Q. So that any two plastics or polymers which cannot be mixed into a single phase are considered incompatible? A. That's right.

Q. What is your understanding of the expression "fiber forming polymers"? A. "Fiber forming polymers," as I understand it generally, is the property of forming a useful fiber, when it has strength sufficient to be useful, when extruded through a die or a spinnerette, or what have you, to put it in the form of a thread or fiber.

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(392) MORTON SCHLUSSEL, called and sworn for the defendant, testified as follows:

The Clerk: May we have your full name and address, please?

The Witness: Morton Schlussel, S-c-h-l-u-s-s-e-l.

The Clerk: And your address for the record.

The Witness: 3039 Sedgwick Avenue, Bronx 68.

Direct examination by Mr. Churchill:

Q. How old are you, Mr. Schlussel? A. 50.

Q. Where are you employed? A. Self-employed at Streamline Plastics.

(393) Q. Streamline Plastics, Inc.? A. Company.

Q. Where are they located? A. 175 Prince Street, New York City.

Q. How long have you been with Streamline Plastics? A. 14 years.

Q. That's since 1941? A. 1941.

Q. What is the nature of the business of Streamline Plastics? A. We do extrusion and injection molding.

Q. Do you do custom molding? A. We do custom extrusion and proprietary injection molding.

Morton Schlussel, for Defendant—Cross

Q. How many extrusion machines do you have? A. Five.

Q. What type of ma ..nes are they? A. National Rubber, mostly.

Q. That's the name of the manufacturers? A. That's the name of the manufacturer, that's right.

Q. In extrusion molding have you ever used Tenite 1 or Tenite 2? A. We do.

Q. How long have you used Tenite 1 or Tenite 2? A. Since we began, 1941.

Q. So you have been using Tenite 1 and Tenite 2 in (394) extrusion molding since 1941? A. That's right.

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(409) *Cross-examination by Mr. Greene:*

Q. Mr. Schlussel, is there anything in this Tennessee Eastman book that you produced, Exhibit D-2, that you think is pertinent to this question of producing a product from a mixture of Tenite 1 and Tenite 2? A. Well, the only relation would be that they warn you not to mix the two.

Q. That's the only thing in here— A. Well, they warn you not to mix Tenite 1 with Tenite 2, otherwise you will get a contaminated effect in your material that won't be desirable as an item.

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(416) Q. Did any salesmen for a raw material, your acetate or butyrate, ever give you any information with respect to making products of acetate and acetate butyrate? A. What do you mean?

Q. Well, you buy your material from whom? A. From all the powder suppliers, Tennessee Eastman and (417) Celanese.

(417) Q. Do you have contact with their salesmen, or sales engineers? A. The salesmen come down, sure.

R. Leonard Hasche, for Defendant—Recalled—Direct

Q. Do they tell you how to use that material? A. As to what, as to how to extrude it?

Q. No, what you could use their material for. A. I don't understand.

Q. Well, I mean, they want to sell as much material as they can? A. That's right.

Q. And I am asking you did the Tennessee, or any other salesman ever come around to you and say you could put cellulose acetate and cellulose butyrate together and make a useful product of it? A. They never said that.

Q. No salesman? A. No. They did tell me—we did know—we did know, in the discussion, that that material was contaminated, but I don't think they would go around talking—for me to go against a patent that was involved.

Q. Yes. I really meant before the patent came out. A. No, they never talked about it. Their conversation—any time it came up it was always keeping acetate and butyrate independent.

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(426) R. LEONARD HASCHE, resumed the stand:

Direct examination (continued) by Mr. Churchill:

Q. Dr. Hasche, are there any temperature limitations imposed in the proper extrusion of Tenite 1 and Tenite 2? A. Well, the temperatures of extrusion are usually known by the operator. Temperatures may run 350, 400 degrees Fahrenheit, depending on what type they are using.

Q. What is the desired temperature in connection with extruding various types of plastics? A. That's pretty hard to answer. There are so many grades. You mean the different types, not only acetate, butyrate, but others?

Q. Yes, sir; and others. A. Well, many of the plastics, such as styrene, I think are usually lower temperatures, methyl methacrylate. Every plastic has its ideal temperature of molding, depending upon the softening point.

R. Leonard Hasche, for Defendant—Recalled—Direct

Q. Now, how high a temperature do you use with each plastic? A. Well, nylon is one of the highest melting point plastics. Nylon has a softening point of around 400 degrees, or above, Centigrade—or Fahrenheit.

Q. Now, what is the recommended temperature for extruding cellulose acetate, Tenite 1? A. It depends entirely on the grade of Tenite.

(427) Q. You say the grade. Does that mean—A. The softness or the hardness of it.

Q. So that Tenite 1 comes in more than one hardness? A. Oh, yes.

Q. How many hardnesses? A. I think about four.

Q. Does Tenite 2 come in more than one hardness? A. Yes.

Q. So the temperature of Tenite 2 would also depend upon its hardness, is that correct? A. That's right.

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Q. Are you aware of what would happen if you took an admixture of Tenite 1 and Tenite 2 and ran it through an extrusion machine at a temperature above that customarily used? (428) A. Ordinarily when you run it too high, if you had orientation, you would break that down, you would get a random distribution, if you heat it too high.

Q. Would you get longitudinal fibers if you overheated it or heated it too high? A. If you had them before, you would certainly lose them if you heated it too high.

Q. So that in order to produce extruded strip from Tenite 1 and Tenite 2 and get longitudinal fibers the temperature of extrusion is quite critical, isn't it? A. Yes.

Q. And if you went to too high a temperature you would get no longitudinal fibers at all. A. Well, you might get some.

Q. What type of product would you get; is there a name for it? A. Well, you would get a product that has more of a random distribution.

Q. Would it be fused? A. Yes.

Q. I should now like to return to our discussion or questioning of this morning, Dr. Hasche, about the fiber forming characteristics of certain plastics. Would you please state whether there are certain plastic materials which are known as fiber forming plastics or polymers? (429) A. Fiber forming, according to my definition, is, as ordinarily understood, a useful product, one that has some strength and has some commercial value. It may be in various forms. It may be in the form of a monofil, as a bristle, or it may be in the form of a very fine filament, such as a yarn, a bundle of fine filaments which are composed of fibers, such as yarn, synthetic yarn.

Q. And what are some of the well known fiber forming polymers? A. Well, of course, there are the cellulose derivatives, ethylcellulose, cellulose acetate, cellulose nitrate; there are the super-polymers, so-called, Neoprene, Dacron; and there are fibers made from polyvinyl chloride, such as Vinyon, or the German Igelite.

Q. Is that nylon a fiber forming polymer? A. It certainly is.

Q. One of the well known ones. You didn't mention methyl methacrylate. Is that a fiber forming polymer? A. Not according to my definition.

Q. Have you ever seen toothbrush bristles or hair brush bristles— A. Yes.

Q. —made of methyl methacrylate? A. No.

Q. Not used for that purpose. (430) A. No.

Q. Because it is not fiber forming? A. According to my definition.

Q. Now, in fiber forming polymers which are run through a reduced size orifice, small orifice, through an extrusion die having a small orifice, what is the effect of running such a plastic through that small orifice? A. It

depends a great deal on the material. Ordinarily orientation occurs in which you get a lineal fiber.

Q. The molecules align themselves, do they,— A. That's right.

Q. —parallel to the wall of the die? A. Yes.

Q. If you do not have a fiber forming polymer, under your definition, can you produce a thread? A. You can make a monofil out of most anything, but it may not have any strength, it is not useful.

Q. Cellulose acetate and cellulose acetate butyrate, under your definition, are fiber forming polymers, are they not? A. They are.

Q. So that if either— A. I might qualify that, that they are not ordinarily made in this way. They are not made from a melt, they are made from a solvent.

(431) Q. But they are used to produce fibers? A. That's right.

Q. Cellulose acetate is used for producing a textile fiber— A. That's right.

Q. —synthetic fabric, is it not? A. Yes.

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(437) Q. Will you now please refer to the prior art patents which have been set up in the defendant's answer and outline, if you will, please, the pertinency of these various patents to the invention here involved? A. Patent No. 2,223,376, Charles J. Malm is the inventor, assigned to Eastman Kodak Company. This patent covers a fiber made from cellulose acetate butyrate. I believe it also covers acetate butyrate propionate, in which the polymer is dissolved in a solvent and spun.

I think this patent is entirely acetate butyrate here, containing a varying amount of one to six per cent of butyryl. No, there is a reference to propinyl, too, on page 2, the second column, line 23.

R. Leonard Hasche, for Defendant—Recalled—Direct

Q. Mr. Malm was interested in producing a yarn, is that correct? A. Mr. Malm is considered the father of mixed cellulose esters, I believe. He took the basic patents. I believe Mr. DeBell pointed out that Hercules were working on them about the same time, and Hercules are licensed under Eastman on mixed esters.

Q. Take the next patent, please? A. The patent of Goessling, U. S. 2,353,457, unassigned, by Gerald A. Goessling. This is a much discussed patent in this suit of taking two incompatible polymeric materials (438) and injecting them through a die into a cavity in which the pearlescent effect was obtained in the product.

Q. And what two incompatible materials does Mr. Goessling suggest using? A. Styrene and methyl methacrylate, I think, are his preferred materials.

Q. Does he mention any others? A. Yes, he mentions—on page 2, the second column, lines 15 through 17, "Another such mixture is cellulose acetate butyrate and vinylite (vinyl chloride). The pearl effect can also be produced by the mixture of three or more different resins, as Lucite, Vinylite and stryene."

Q. Cellulose acetate butyrate is one of the materials we had under discussion. Is vinylite, or vinyl chloride a fiber forming material? A. Yes.

Q. So that this patent does teach that you can mix cellulose acetate butyrate, a fiber forming material— A. That's right.

Q. —with another fiber forming material? A. That's right.

Q. Now, Mr. Goessling got a pearlescent effect, according to this patent. Can you explain why such effect comes about? A. Yes, he had two incompatible resins. He injected (439) them into a die and he obtained a random distribution of material, and it gave this pearlescent effect.

R. Leonard Hasche, for Defendant—Recalled—Direct

Q. That is because of what reason, that he got the random orientation, or pearlescent effect? A. Well, probably when he went through the gate into the die the sprue was oriented, but once it expanded into the cavity of the die, and the die was completely filled he got random distribution, as you would expect.

Q. So that the random distribution results from the fact that it is sprued into an open area, is that correct? A. Yes.

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(441) Q. Would you take up the next patent, please? A. Heinrich Jacque, U. S. 2,185,789, assigned to I. G. Farben.

Q. What is the date of this patent? A. The date is January 2, 1940. And this patent, briefly, concerns the preparation of a fiber by breaking up, by friction, a stretched foil into threads.

Q. What materials were used in the preparation? A. Polyvinyl chloride in example 1; example 2, polymerized styrene; and in example 3 afterchlorinated polyvinyl chloride.

Q. Are those fiber forming polymers? A. Yes, vinyl chloride and polyvinyl chloride, particularly; styrene is on the border line, I would say. That is about all that patent concerns, I think, that is pertinent.

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(442) Next is Camille Dreyfus, U. S. 2,050,286, patented August 11, 1936. We all know that this man is a very prolific inventor. As usual, he is in this field, and this is drawn to an artificial straw, which is made by coalescing filaments into a bundle.

Q. What is the basic material used for preparing those filaments? A. He describes a great many of them. He covers the cellulose esters, and the ethers, and on page 1,

column 2, lines 12 and following, cellulose formate, cellulose acetate, cellulose propionate, cellulose butyrate, and the cellulose ethers such as ethyl cellulose, methyl cellulose and benzyl cellulose.

So this also covers a bundle of fibers, or bundle of filaments to produce a fiber.

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(443) Q. Would you describe what you know about preparing these filaments in the use of a spinneret? What is a spinneret? A. A spinneret is a type of apparatus used for spinning a multiplicity of filaments in which you have extremely fine holes, uniformly spaced, and it can be used both for a melt, such as nylon is spun, or a solvent such as is used in the (444) spinning of acetate, cellulose acetate, or Vinyon, or such of those as are not suitable for melt spinning.

There are very few solvents for nylon, I might say, and no real satisfactory ones for spinning from a solvent. So it is almost universally done from a melt.

Q. So when you have a melt you force it through these hundred holes, is that correct? A. Yes.

Q. And form a hundred filaments? A. Yes.

Q. And then twist them together to make the yarn, is that correct? A. That's right. I might say that this is not the commercial nylon here. This is one of his poly esters. He has a great number of them. That is, this is not nylon, this is one of the very many combinations that he discloses in his various patents.

Q. But the practice of using a spinneret is used in connection with the making of nylon yarns? A. That's right. The next is a patent by Henry Dreyfus—

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William L. Searles, for Defendant—Direct

(446) WILLIAM L. SEARLES, called and sworn for the defendant, testified as follows:

The Clerk: May we have your full name and address for the record?

The Witness: William L. Searles, S-e-a-r-l-e-s, Cedarwood Road, Stamford, Connecticut.

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Direct examination by Mr. Churchill:

Q. How old are you, Mr. Searles? A. 55, sir.

Q. Where are you employed? A. In the New York sales territory of Eastman Chemical Products Company.

Q. How long have you been employed by the Eastman Chemical Products Company? (447) A. Since 1953 when the sales organization became Eastman Chemical Products.

Q. Prior to that time what was it called? A. Tennessee Eastman Corporation.

Q. And how long were you employed by Tennessee Eastman Corporation? A. Since approximately 1933.

Q. And what work did you do for Tennessee Eastman Corporation? A. Technical sales of plastics molding compositions.

Q. In what area? A. In the New York territory.

Q. Does that include part of New Jersey? A. Yes, sir.

Q. What molding compositions or extruding compositions do you sell, or have you sold, for the Tennessee Eastman Company? A. Two compositions, one known as Tenite 1, which is a cellulose acetate molding composition, the other known as Tenite 2, now generally called Tenite butyrate molding composition.

Q. And what are some of the uses for which these materials have been sold? A. For use by molders and extruders

in making solid, I would say, molded objects, such as automobile steering wheels, radio knobs, appliance components, extruded trim, and such (448) as that.

Q. Is extruded trim similar to or like a strip material? A. Yes, it can be in the shape of channels or keys, or "v's".

Q. When was Tenite 1 first offered for sale by you? A. Approximately—by me or the company?

Q. By you. A. By me, in 1934.

Q. And has it been sold ever since? A. Yes, sir.

Q. When was Tenite 2 first offered for sale by you? A. I believe in 1938.

Q. Has it been sold ever since? A. Yes, sir.

Q. What is the nature of Tenite 1 before it is molded? A. It is supplied by us to molders and extruders in the form of either granulation of approximately five sixteenth inch particle size, and in cubical pellets approximately one-eighth inch in size.

Q. And what is the nature of Tenite 2 before it is molded? A. It is supplied in the same shapes and forms.

Q. I show you four bags of material and ask if you can recognize those materials. A. They are the same forms and size in which we supply (449) our cellulose molding compositions.

Q. You recognize each of these bags as containing pellets of the size which you sell under the names Tenite 1 and Tenite 2? A. Yes, sir.

Mr. Churchill: I ask that the three additional bags be marked for identification as Defendant's Exhibits.

The Court: I don't think Mr. Greene has any objection to letting them go into evidence at this time, have you?

Mr. Greene: If the witness says they are products of Eastman, of course, no objection.

The Court: Are they, Mr. Searles?

The Witness: That I cannot say without testing. I said they are in the size and form, pellets, in which we do supply our molding compositions.

Q. How are Tenite 1 and Tenite 2 supplied to the customers, what sort of packaging? A. Usually in fiber packed drums, cylindrical drums, ranging in size from approximately ten pound capacity up to approximately 300 pounds capacity.

Q. Do such drums contain labels? A. Yes, sir.

Q. I show you what has been offered in evidence as Plaintiff's Exhibit P-23 and ask you if you recognize on (450) this exhibit any labels which have appeared on drums of Tenite 1 or Tenite 2? A. Yes, I do.

Q. Which label do you recognize? A. Well, of course, the ones with the name "Eastman Plastic" and the one saying, "Keep drum covered."

Q. So you recognize the labels on the entire left column? A. Yes, sir. And this is a photostat of a packing slip sent with material to the customer.

Q. When you send the material to a customer is it the practice of the Tennessee Eastman Company to send a packing slip along? A. Yes, sir.

Q. And is the packing slip the photostat in the lower right-hand column such a packing slip? A. Yes, sir.

Q. Are such packing slips in current use today? A. Yes, sir.

Q. I invite your attention to the notation at the bottom of the packing slip which reads, "Tenite 1. Do not mix with Tenite 2." How long has that notation appeared on packing slips? A. I believe that was begun around 1942.

Q. Is that notation still used today? (451) A. Yes, sir.

Q. So that on packing slips today which accompany Tenite products, you still admonish the customer not to mix Tenite 1 with Tenite 2? A. Yes, sir.

The Clerk: D-12 for identification, bag of white butyrate, Tenite 2; D-13 for identification, bag of white butyrate; D-14 for identification, bag of clear butyrate marked Tenite 2.

(Marked Exhibits D-12, D-13 and D-14 for identification.)

By Mr. Churchill:

Q. Do you remember the reason why this warning notice was started in 1942? A. Yes, because we knew that mixture of a cellulose acetate plastic with a butyrate—cellulose butyrate plastic would result in surface imperfections in molded articles which were undesirable.

Q. Did you know what would happen if the two were mixed and extruded into strip form? A. We would expect that there would be surface imperfections apparent in the extruded product.

Q. Would you expect to get any fiber formation? A. We weren't looking for the formation, or for a definition for the formation. We weren't concerned with that. It was simply the surface imperfections of the molded parts (452) which we were concerned with.

Q. Did you ever see Tenite 1 admixed with Tenite 2 and extruded into strip form? A. I have seen the mixture of Tenite 1 and Tenite 2 come out of extruders, either through dies or without dies.

Q. Did you ever examine the product thus produced? A. Looked at it, yes.

Q. Did you flex it? A. Possibly.

Q. Do you recall what happened when you flexed it? A. It bent.

Q. Did it break? A. If flexed enough the surface would crack.

Q. But did the extruded product break off with a clean break? A. Sometimes, depending upon, I think, the percentages of the mixture.

Q. Sometimes it didn't break, is that correct? A. That's correct.

Q. And if it didn't break, what did you observe? A. We assumed it was a soft flow material.

Q. What was the physical observation which you made of the strip which didn't break? A. Which didn't break?

Q. Yes. (453) A. No particular observation other than it appeared to us to be useless material.

Q. Did it have a fibrous construction when it was flexed considerably? A. In some cases the appearance might be described as fibrous.

Q. Was there any use for that type of material in 1942? A. We didn't think so.

Q. Was there any trade expression for characterizing admixtures of that type? A. Sir?

Q. Was there any trade expression for characterizing admixtures of that type? A. Well, there were terms such as spuings and scrap. It was generally referred to as scrap, I believe.

Q. Was the material also said to be contaminated? A. Yes, one would be contaminated by the other.

Q. One contaminated the other? A. Yes, sir.

Q. In your position as sales representative for the Tennessee Eastman Company did you ever have occasion to call on molders at their plants? A. Yes, sir.

Q. Did you ever explain to molders why Tenite 1 and Tenite 2 should not be admixed? (454) A. Yes, sir.

Q. What did you tell them? A. That they could expect and would probably get surface imperfections which were undesirable.

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(457) Q. Did you supply this book to me? A. Yes, sir.

Q. And what is the nature of that book? A. It is a booklet of recommendations for injection molding techniques in the molding of our molding composition.

Q. Is it a technical publication put out by the Tennessee Eastman Company? A. Yes, sir.

Q. To whom was it distributed? A. To molders, and extruders and prospective users of our material.

(458) Q. When was this book published? A. This is an edition, I believe, of 1940.

Mr. Churchill: The book to which the witness is referring has heretofore been identified as Exhibit D-1.

Q. Was that book distributed in the metropolitan area? A. Yes, sir.

Q. Can you state for me how many copies were distributed in the metropolitan area? A. I have no idea, sir.

Q. Can you say there were not less than so many? A. Well, not less than what?

Q. Several hundred. A. I would say probably not less than a hundred.

Q. So at least a hundred were distributed— A. I believe so.

Q. —to molders? A. Yes, sir.

Q. Would it be normal practice of the company to distribute a book like this to Keystone Plastics Company, the defendant here? A. Yes, sir.

Q. And to Anchor Plastics, the plaintiff? A. Yes, sir.

William L. Searles, for Defendant—Direct

Q. I particularly refer you now to page 4, which contains the quotation which is set forth—or which contains (459) the material which is quoted in the memorandum dated May 20, 1954, and ask you to read that portion, and then explain or state why that statement was included in the recommendations to the molders. A. The statement reads, "It should be noted that Tenite 1 and Tenite 2 cannot be mixed in molding. Since the two plastics are incompatible, the scrap from each must be kept separate in order that it may be molded again."

Q. Was that the purpose of the warning to molders to keep this scrap separate so that it can be remolded again? A. The purpose was to prevent, or avoid, where possible, the imperfections resulting in molded parts from the mixture of the two materials.

Q. And if they did get admixed then the scrap would not be remoldable, is that correct? A. That is not exactly correct. As far as our knowledge of the use of our materials went, the resulting mixture would not be commercially usable. It could be re-extruded and remolded, but to our way of thinking people didn't want what come out in the form of a product with surface blemishes. We were simply trying to help the customer get what he wanted, and our experience was that he wanted unblemished, highly polished and lustrous surfaces.

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(460) Q. Do you know of any product which is produced today by the admixture of Tenite 1 and Tenite 2, aside from the boning material which is here involved? A. No, I don't.

Q. There is no other product, of your knowledge, today which requires, or wherein it is desirable to mix Tenite 1 and Tenite 2? A. Not that I know of.

William L. Searles, for Defendant—Cross

Q. Is it one of the services rendered by the Tennessee Eastman Company to help molders out with their molding problems? A. Yes, sir.

Q. Are you frequently consulted by molders when they run into difficulties in the use of your product? A. Yes, sir.

Q. What are some of the difficulties which frequently occur which require your attention? A. They are imperfections in the molded parts which make (461) them rejects.

Q. The molded part has imperfections in it which give rise to rejection? A. That's right.

Q. And you then try to solve the problem— A. Yes, sir.

Q. —of what caused the imperfection? A. Yes, sir.

Q. What are some of the common causes of such imperfections? A. Too much moisture in the material, excessive temperatures in the equipment, molding equipment, other elements of the molding or extrusion technique which are not optimum for the production of good parts from our material.

Q. Foreign substances getting into the raw material one of them? A. Foreign substances, contamination.

Q. Contamination by admixing two incompatible materials? A. By two incompatible materials becoming mixed.

Q. Which gave rise to a contaminated or undesirable product? A. Yes, sir.

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(468) *Cross-examination by Mr. Greene:*

Q. Mr. Searles, the function of sales in the raw materials industry is, I suppose, multiple, you don't simply take orders and deliver them, do you? A. No, sir.

Q. I think it is fairly clear that you represent technical sales, service, in the form of advice to customers. A. Yes, sir.

Q. How would you describe your services other than the mere taking of orders to customers? A. By offering

suggestions in mold or die design, by suggesting formulations of material which appear to us to be most suitable for the particular application, helping the molder find the source of trouble that he may encounter in molding the material. That's about it.

Q. Where do you get the background or information by means of which you can do those services? A. From work done at our factory with our materials in the development laboratories, experience gained there, by study of technical literature on the materials, and from experience (469) in the field, working with molders and extruders.

Q. Is it proper to say that you convey that information to the customer by means of your publications and your personal contact? A. Yes, sir.

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Q. Is Tenite 1 used to make a thread? A. The nearest approach to a thread that I know is a solid (470) rod called a monofilament and the smallest diameter, I would say, is in the neighborhood of twenty thousandths of an inch diameter.

Q. Is that a fibrous body? A. No, sir; I believe not.

Q. When I say "fibrous body"—what does "fibrous body" mean to you? A. Thread like, made up of a series—or a structure of individual fine—like threads.

Q. If you couldn't separate it into threads, or see it as a separation of threads, under some circumstances would you regard it as fibrous? A. I believe so.

Q. When would that be? A. If the structure were easily recognized as being made up of fine thread-like sections.

Q. I think you misunderstood my question. I did mean that, that an extruded monofil, for example, that you speak of—is that a fibrous body? A. No, sir; that is not.

Q. And I think you could say it is not fibrous because

it doesn't look fibrous, you can't pick it apart, and it isn't composed, so far as we know, of a fine, smaller, longitudinal body. A. No, sir; it is a homogeneous solid mass.

(471) Q. I am just handing you this P-6, which is Bonar, as you know, and say whether that is the same—whether that is a fibrous structure. A. That looks to me like a fibrous structure.

Q. Would you say that is the same or a different structure than a Tenite 1 monofil? A. Different structure.

Q. Would it be different in properties? A. I believe it would.

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(472) Q. Let me put it this way, do you know of any extrusion of cellulose acetate, either in Tenite 1, or anything else, even the thread forming material, which body when extruded is in itself a fibrous body? A. No, sir; as I say, the nearest to a thread would be a small diameter monofilament, and when such a thread is made from acetate or butyrate, uncontaminated, I believe there is no fibrous structure to the monofilament.

Q. That is the kind of a thing that is used in a toothbrush bristle, I suppose, a monofil? A. Yes.

Q. And that has got an internal homogeneous structure, like ice, a rough analogy, is that correct? A. I believe so.

Q. Applying those same facts to Tenite 2, which is the butyrate composition, are all the same facts true with butyrate with respect to its being fibrous or making a fibrous product of itself? A. I believe so.

Q. In other words, could you make, so far as you know, by any composition of cellulose acetate butyrate, by the extrusion of that product, a fibrous body of any kind? A. It may be possible, but I don't know of a way to do it, other than possibly loading the material with moisture, which

would give a scaly surface effect, but whether it (473) would be fibrous, I doubt; I don't know.

Q. Did you ever do it? A. Not on purpose. I have seen extruded products which contained excessive moisture, and have seen in the surface of such product pimples, scaly blotches, and so on.

Q. Is that a useful product, according to your terms? A. No, sir.

Q. Can you compare it with the Bonar product that you hold in your hand? A. Uncontaminated extruded acetate or butyrate would be a solid, homogeneous, and—in a clear transparent—showing no sign of any structure.

Q. Are strength and flexibility important characteristics for molded products? A. Yes, they are.

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(478) Q. By the way, what molding materials do these extruders mold, besides Tenite 1 and Tenite 2? A. Poly-styrene, methacrylates, vinyl materials.

(479) Q. Polythene? A. Polythene.

Q. Ethyl oxide—ethyl cellulose, rather? A. Ethyl cellulose.

Q. Are there others? A. Yes, there are co-polymers of styrene. That's a mixture of butadiene and styrene in various percentages.

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Q. Did you ever receive any information from Tennessee Research or development that you could get instead of a brittle cellulose acetate, or any other plastic product, that you could get a flexible, stronger product by using a combination of Tenite 1 and Tenite 2? A. No, sir.

Q. Did you get any information, not just as I have (480) defined it, that would indicate to you that the customers might explore the possibility of using this mix usefully for any kind of a product? A. No, sir.

William L. Searles, for Defendant—Cross

Q. If Tennessee development and research had such information would it come to you? A. Yes, if they thought it of value to the molders or the trade.

Q. Wouldn't you say that would be one of the primary functions of research, to supply you, Mr. Searles, with information of use to pass along to your extruders? A. Yes, sir; with the aim of expanding the field of use of the material.

Q. Because you want to sell as much of your product as you can? A. That's right.

Q. And you want the molders to have all the information you can, and to make the best products they can, so that you can compete with the other plastic materials made by other manufacturers? A. That's right.

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(485) Q. Did you know that cellulose acetate, or Tenite 1, was used for a boning material in 1946, '47, '48 and '49? A. I knew that it had been tried by itself for such a use.

Q. Well, did you know that it was being sold on the market in quantity? A. No, sir; I don't know whether it was or not.

Q. Did anyone ever ask you what you could do about making a material that wasn't as brittle as cellulose acetate? (486) A. Yes, we have been asked that, and, so far as we know, the least brittle cellulose acetate material we can make is one containing the highest percentage of plasticizer which it will accommodate. That is not changing our composition, except in its hardness or flow, as it is termed in the trade.

Q. The point has been made here that the plaintiff never went to you, the supplier, Tennessee Eastman, and asked them for a solution of the problem of how to make a boning stay that wouldn't break when bent sharply. If

they had asked you that, what would you have told them to do? A. We would probably have recommended using the softest flow material that we make as being the most flexible and least brittle of a cellulosic material which we made, or can make.

Q. And if they asked you for a material which a needle wouldn't break when it hit it, what would you have recommended then? A. The same material, our softest flow of either acetate or butyrate, whichever one they wanted to use.

Q. And if they said that wasn't stiff enough for a boning support material, what would you have suggested then? A. I am afraid we would have said, "We are at the end of our rope."

Q. Would you have suggested the combination of Tenite 1 and Tenite 2 for the solution of that problem that I recited? (487) A. I think definitely not.

Q. Did you ever recommend, or think of recommending the combination of Tenite 1 and Tenite 2 for the solution of any problem? A. No, sir.

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(490) Q. What I would like to arrive at here is whether in the industry everybody knew that you could make a fibrous body by this combination, but never had to sew one, or whether this was an occasion in which you can say now, in retrospect—I knew that that mass was fibrous, and I could have made a fiber body if I wanted it? I say that because a fibrous body is not unusual, or a new type of structure, so that no one ever thought it would have utility, fibrous structures are known to be stronger and more flexible than ice—or I call it an ice-like body which fractures sharply, but still there is no sign anywhere that you, or these others, can say more than—well, I saw a body that I thought could be described as fibrous now. A. I believe that's right.

William L. Searles, for Defendant—Cross

Q. Was it a subject that was discussed in the trade, or that you really could say, if a customer said, "I want to make a fibrous body," you would have said, "Why, I know just the way to make it"? A. I doubt that that question can be answered honestly—I don't mean "honestly," but I mean with any feeling of confidence. I don't know what I might have said. The only fact remains that I never was asked how to produce a (491) fibrous extrusion, and I don't know whether, had I been asked, that I would have suggested mixing the two materials. I rather doubt that I would have suggested it.

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Q. Supposing that Anchor Plastics, or anyone else, had come to you and said that the cellulose acetate strip breaks too easily when flexed, "I want one that is stronger." You have said before how you would suggest that. Would you have suggested that a fibrous body be attempted? A. By a "fibrous body attempted" you mean that we try to make a fibrous body of this?

Q. Yes. A. Probably the nearest to that suggestion we might have made would be to extrude a fibrous material, such as a thin skein of yarn, or rope, through an extruder and coat it with plastic. If you want the plastic appearance, and the strength of the fibers, then possibly you might achieve that by coating or covering yarn with a thin coating of the acetate.

Q. All right. Then the implication that one, to solve the problem of a stronger strip, would just naturally have turned to seeking a fibrous body is not the path that you, as one long and well skilled in this art, would normally (492) have turned to? A. No, we wouldn't. We would have thought, I believe, as we have thought, and have suggested in other situations, combining two materials in such a way that the advantage of the plastic could be had

and the advantage of the other material had, also, in the combination, however they might be combined.

Q. Do you think this is a better or worse way of solving the problem? A. Well, I think that that answer would have to be applied specifically to a certain application, that you couldn't generalize on that.

Q. Well, that solution that you suggest of combining with a core material of fabric, or textile, or even wire, was tried by Anchor Plastics—the evidence shows that clearly—and it didn't work. Now, I am saying to you, in effect, isn't this a very clever solution to that problem? A. You want my opinion?

Q. Yes. A. I believe it is. That is just an opinion.

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(493) Q. Do you know of any way used in the plastics industry for making a fibrous body of that type, a two-phase body, by merely using two materials together in extruded form? A. I don't know of any.

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(496) *Recross examination by Mr. Greene*:

Q. What is a fiber? A. What is a fiber?

Q. Yes. A. My definition of a fiber would be a thread-like length of material.

Q. Is a fiber forming the same thing as a fibrous material? A. I would say no.

Q. Why? (497) A. Fiber forming is a material which is not yet a fiber. It may be formed into a fiber. A fibrous material is a material which is already fibrous in structure.

Q. All right. I think we are still a little bit confused. When you form the fiber of cellulose acetate, is that fiber a fibrous material? A. You are out of my field now. That is in the yarn field and I am not able to say.

Q. Is the monofil—which I understand is simply a larger orifice—when you extrude acetate or Tenite through that, is that monofil a fibrous body? A. No, sir.

Q. Why isn't it a fibrous body? A. Because the material just doesn't form itself into fibers as it is extruded uncontaminated through a small orifice.

Q. It is a solid body. A. Solid, homogeneous body.

Q. Not like a piece of rope? A. No, sir.

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(504) GEORGE STREISGUTH, called and sworn for the defendant, testified as follows:

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(508) Mr. Churchill: I ask that an injection molded sample of clear material be marked for identification as Defendant's Exhibit 17.

(Marked Exhibit D-17 for identification.)

Q. I show you what has been marked for identification as Defendant's Exhibit D-17 and ask you if you recognize it. A. Yes, this is a sample that I prepared at your request of an injection molded piece where I have used the two (509) materials, cellulose acetate and cellulose butyrate, and run them through the injection molding machine.

Q. It is clear plastic you used, is that correct? A. That's right, it's clear.

Q. But this was injection molding and not extrusion molding? A. That's right.

Q. Can you tell whether that sample has been contaminated or not, from the standpoint of being fibrous? A. It is not obvious when you look at the piece.

Q. How would you tell? A. The only way I could tell, or anybody else could tell, would be to take and flex the material, and otherwise abuse it, so that the fibers will

separate from the apparent solid piece that it now consists of.

Q. Will you show how it is done with one of the rods? A. (Witness complies.)

Q. What do you observe? A. Well, the material separates rather difficultly and after a while it does tend to pull apart and separate into fibers, which are otherwise not very well noticed.

Q. The fibers show up after flexing, is that correct? A. After they are flexed and abused in such a way as to bring the—

Mr. Greene: Can I have one of those to play with (510) while you are testifying?

The Witness: Certainly.

(Handed to counsel.)

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(526) Mr. Churchill: It has a counterpart on the chart, P-23. This is just evidence—merely to show that these labels are still being used.

I now offer in evidence the various samples of products produced by the witness and which have heretofore been marked Defendant's Exhibits 17 to 25, inclusive.

The Court: Any objection, Mr. Greene?

Mr. Greene: Yes. D-17 was prepared at the request—and is an injection molding piece. It is objected to as being irrelevant from the standpoint of time, because we are not discussing the injection molding process.

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(527) The samples of his products, if taken for simply a sample of his products, and not as anticipation in any way, I have no objection to those.

The Court: I understood you to say that these were extruded, weren't they?

The Witness: This sample, and the sample hat clip are injection molded of a similar composition to the material under discussion in this patent.

Perhaps to illustrate the admonition on the labels, as much as anything else, the problem of lamination, scaliness and so forth.

Mr. Churchill: I want to make the point, your Honor, with this exhibit that the admixture of two incompatible polymers is well understood in the art to give rise to scaliness, brittleness, laminations and fibers, and that whether you go from injection molding to extrusion, it is only a question of orienting the fibers a little more precisely; but this factor of contamination, and scaliness, and fibrous formation, is peculiar to any admixture, whether it is for extrusion molding, or for injection molding, and some of the prior art patents on which we rely teach that you do get these laminations in injection molding. And the witness has produced an injection molded piece which shows this fibrous lamination structure. Now, that is the purpose of this piece.

The Court: I will allow it for that purpose, Mr. (528) Greene.

Mr. Greene: Your Honor understands injection molding in this sense, that the pieces made go into a receptacle, shoved into a receptacle, and harden there and are taken out. I think you know that.

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The Clerk: D-17, 18, 19, 20, 21, 22, 23, 24 and 25, formerly marked for identification, now marked in evidence.

(Received and marked Exhibits D-17 to D-25, inclusive.)

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George Streisguth, for Defendant—Cross

(529) *Cross-examination by Mr. Greene:*

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(564) Q. You couldn't tell it from the product itself, could you? A. The average person couldn't tell it. I could sell that product just the way it is there and nobody would know any different, but it is contaminated. I stated before that (565) where I can use contamination and sell it as a good useful product, and nobody is the wiser, I am just as happy to use up material whether it is contaminated by accident or by deliberation.

Q. Did you ever contaminate by deliberation?

The Court: Just a minute. Does the record show what he meant by "this"?

Mr. Greene: Referring to a piece from D-17.

Q. Do you ever contaminate deliberately? A. No.

Q. Have you ever sold any product that you—by putting together two incompatible materials? A. Yes, from 1949 to '51 I was selling boning deliberately contaminated.

Q. Other than the boning? A. No.

Q. When this material is bent, this piece that I have here—let's mark the piece D-17-A so we know what we are talking about, a separate piece—it breaks, doesn't it?

Mr. Churchill: No objection.

Q. It breaks, doesn't it? A. I don't try to sell that product.

Mr. Greene: I just bent this, your Honor. You bend it and it breaks.

Q. My question is: Does it break? (566) A. Any material will break when it is abused.

Q. I just bent that once and that is what happened, as you see. A. That's right. I agree with you, it broke. Con-

tamination, up to a certain extent, has very little effect on the product other than to weaken it. After you get to a certain point, under certain conditions, the characteristics are better and instead of breaking it would just turn into a shred of fibers.

Q. In this particular case, what is the pertinency of this, if it just weakens it? A. I don't know, sir. I just brought that in as a sample I was requested to make, to illustrate that contamination can occur and produce a certain amount of structure, whether it is injection molded or extruded.

Q. Well, I think we are agreed on that, that any physical composition, a certain amount of contamination won't hurt, but the amount of contamination here you are not saying that makes it the same as Bonar, are you? A. No, I never said that.

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(573) JOHN NOVELO, called and sworn for the defendant, testified as follows:

The Clerk: May we have your full name and address, please?

The Witness: John Novelo.

The Clerk: And your address for the record.

The Witness: 129-17 Rockaway Beach Boulevard, New York.

Direct examination by Mr. Churchill:

Q. How old are you, Mr. Novelo? A. 36.

Q. What is your occupation? A. I am a plastic manufacturer.

Q. Where are you engaged at the present time in the plastic manufacture? A. Waljohn Plastics, Incorporated.

Q. Where is that company located? A. 437 88th Street, Brooklyn.

John Novelo, for Defendant—Cross

Q. How long have you been connected with Waljohn? A. It will be ten years this month.

Q. Before that time where were you employed? A. By the Whiteford Plastics Company.

Q. Where was Whiteford located? (574) A. 66th Street in New York City.

Q. And how long were you employed by Whiteford? A. Around five years.

Q. From what year to what year? A. About 1940 to 1945.

Q. What type of work did Whiteford do? A. We were extruders, custom extruders.

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(585) *Cross-examination by Mr. Greene:*

(593) Q. Did you ever extrude two incompatible materials like acetate and butyrate? A. Yes.

Q. For a useful product, I mean, that you meant to? A. Well, not in acetate and butyrate, but I have done it in something else.

Q. Which ones? A. I have done it in styrene and vinyl.

Q. What was the product there? A. That was a wide belt. It gave a very nice effect.

Q. What, a mottled effect? A. It gave more like a Morocco grain.

Q. I don't know what that is, but it is a design effect. A. It looked like a piece of leather.

Q. When did you do that? A. Oh, maybe 1950, somewhere around there.

Q. Any others? A. Well, we are always doing something with different (594) materials. I mean we don't particularly experiment too much with that, but we once in a while do.

Q. I would be interested to know if you did anything

else with two incompatible materials. That is what we are here for. A. Well, we run Lucite and styrene.

Q. Are those incompatible? A. Well, they are compatible up to a certain point. The thing is this, that if you add a small percentage of Lucite to styrene you get a pearlescent effect.

Q. Oh, yes. That's right. A. And we do that.

Q. We have a patent here, Goessling, where they mix styrene and Lucite and get a mottled pearlescence. Do you have that sample? Let's see if that's what we are talking about. (Article shown to witness.) Is this what you are talking about? A. Yes, something like that.

Q. That's what you are talking about? A. Yes.

Q. Referring to Exhibit P-36—this is the way it actually looks in our form here. A. You mean you have a patent on that?

Mr. Greene: No.

The Court: And that is known as a pearlescent (595) effect.

The Witness: Pearlescent effect, yes.

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Joseph Wilson, for Defendant—Direct

(601) JOSEPH WILON, called and sworn for the defendant, testified as follows:

The Clerk: May we have your full name and address, please?

The Witness: Joseph Wilon, W-i-l-o-n, 1436 51st Street, Brooklyn.

Direct examination by Mr. Churchill:

Q. In what business are you engaged, Mr. Wilon? A. We are stamping out sequins.

Q. Under what business name do you do business? A. Plastic Spangles, Incorporated, and Just-Rite Novelty Company.

Q. So you do business under two names? A. One is a selling agent and one is manufacturing.

The Court: Which one is the manufacturer?

The Witness: Plastic Spangles, Incorporated. We manufacture sequins.

Q. You are the Joseph Wilon who does business under the name of Just-Rite Novelty Company? A. I am.

(602) Q. An individual doing business under that name? A. That's right, an individual.

Q. Plastic Spangles, Inc., is a corporation? A. Right.

Q. What type of products do you sell under the name of Just-Rite? A. We sell collar stays for men's shirts, also the strippings for what they use in sleeveless dresses, or evening gowns, also in strapless brassieres. What other use—there are many uses that it is being used for, we don't know. A customer calls and we supply them the stripping.

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(615) Q. Are you still selling brassiere stay material which can be sewn across? A. I do.

Q. Who makes it for you? A. Keystone Plastics.

Joseph Wilson, for Defendant—Cross

Q. How do you buy it from Keystone Plastics? A. By the pound, continuous lengths.

Q. And who cuts it to length? A. My places does.

Q. And you sell it to the customer? A. Yes.

Q. Did you buy this material from any other concern besides Keystone Plastics? A. Yes, I did.

Q. From what other concern? A. From Apex Plastics.

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(628) *Cross-examination by Mr. Greene:*

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(653) Q. So you knew about it then, if not before. Do you know what your customers used this product for? What do you call your product, by the way? A. Call it now Boneflex.

Q. When did you start calling it that? A. From the telephone company. They came to advertise my product, to put in an ad. They suggested that I use that name.

The Court: They gave it to you?

The Witness: They gave it to me.

The Court: Gratis?

The Witness: Gratis. From then on. I think from the inception—

The Court: When was that?

The Witness: From the inception of the boning era, I mean that I started to sell.

Q. Well, when was that, do you recall? A. It must have been the beginning of 1950.

Q. The beginning of 1950? A. That's right. They put in an ad in the telephone book (654) for me under the name of Justrite Novelty, and you will come across the Boneflex there.

Q. I see. And have you used it since then for the product? A. I have been using it, yes.

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(658) WILLIAM GOULD, called as a witness in his own behalf, being duly sworn, testified as follows:

The Clerk: What is your address, sir, for the record?

The Witness: 93 Sagamore Road, Milburn.

The Court: You are the defendant in this case, is that right, Mr. Gould?

The Witness: Yes, sir.

Direct Examination by Mr. Churchill:

Q. What is your business, Mr. Gould? A. Plastic extruding.

Q. How long have you been in the plastic extruding business? A. Thirteen years.

Q. Under what name do you do business? A. I have been in business under Keystone Plastics for the past ten years.

(659) Q. Is that a corporation? A. Corporation.

Q. And what is the business of Keystone Plastics, Inc.? A. Custom extrusion.

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(672) Q. When did you supply Mr. Wilon with the first material composed of acetate and butyrate mixed? A. It was in November, 1949.

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William Gould, for Defendant—Cross

(691) *Cross-examination by Mr. Greene:*

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(716) The Court: I don't know.

Q. What is your business, Mr. Gould? A. Plastic product and Bonar, which is the plaintiff's product? A. I don't know, I never tested both of them.

Q. Do you think there is any material difference from (717) what you know now? A. They both serve the same purpose, as I see it.

Q. Is the material, 17-A, stronger or weaker with respect to bending or flexing than straight, say, cellulose acetate? A. This is weaker.

Q. So 17-A is weaker bend-wise, break-wise, than acetate or acetate butyrate strips? A. You could take an acetate and butyrate—

Q. No, wait.

The Court: Just give him the question.

Mr. Churchill: Now, there again, Your Honor, he is joining two products in one question, acetate, alone, and acetate butyrate combined. He should ask one question at a time from the standpoint of comparative strength.

Mr. Greene: I don't agree, I think this can be weaker than both, and he said it is weaker than both, and I don't see why I should ask two questions.

The Court: It seems so to me. If he can't answer when he puts the question that way, just say, "I can't answer it."

Mr. Greene: He has answered it already.

The Court: I thought he did before.

The Witness: I said it is weaker.

The Court: He said 17-A is weaker.

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R. Leonard Hasche, for Defendant—Recalled—Direct

(741) R. LEONARD HASCHE, resumed the stand.

Direct examination (continued) by Mr. Churchill:

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(746) Q. Well, now, having covered these prior art patents, will you please state in summary what your observations are as to what these patents teach in broad scope? A. Well, the patents of Carothers, and the Celanese, and Malm, show that cellulose acetate and acetate butyrate were known to be fiber forming polymers and could be produced—or could be converted into yarns, useful synthetic yarns; also that acetate and acetate butyrate were known to be incompatible. If you will notice from the Malm patent that he spun separately the acetate propionate and acetate butyrate; in other words, they are not made into a single dope, but they are spun separately.

The third is that incompatible polymers, for instance, (747) the Goessling patent, if they are spun—if they are forced through an extrusion die, still retain their individual characteristics.

Q. Or solid phases? A. That's right, the solid phase. And finally that the fiber forming polymers, cellulose acetate and cellulose acetate butyrate, are capable of forming long threads when extruded through very small orifices.

I think that pretty well summarizes all of the teachings of the patents.

Q. Having in mind the teachings of these patents, Dr. Hasche, if you were given the problem, as a man skilled in the art, to produce a strip having longitudinal fibers which could be sewn across, what would you do? A. If it were in the plastic art I would make two incompatible polymers.

Q. And do what with them? A. Put them through an extrusion die to obtain a coalescent unitary article which would show these properties.

R. Leonard Hasche, for Defendant—Recalled—Direct

Q. Would it make any difference whether the two polymers which you selected were fiber forming or not? A. Yes, I think so.

Q. What type would you select? A. These two examples are very good; there are many others that could be used, the nylon type with another fiber former, (748) such as ethyl cellulose or vinylite, which would work equally well.

Q. To produce fibers? A. That's right.

Q. Because of incompatibility? A. Yes.

Q. Will you particularly refer now to the Goessling patent and then to this Exhibit D-17 and D-17-A, which constitutes the injection molded product, and point out where you find any similarities or differences between Goessling and that injection molded product. A. Well, as I see it, the main difference here between Goessling, where he shows a pearlescent effect, you have there random distribution of the two phases, because he has extruded into a cavity and the only place that you would expect any orientation would be in the sprue between the die and the cavity.

Q. Would you please particularly refer to what Mr. Goessling says as to Figure 3 of his patent drawing. A. Where is that?

The Court: Column 1, Page 1, Line 39: "Fig. 3 is a view of a broken specimen,"—

The Witness: I don't find it, your Honor.

The Court: Page 1, Column 1, Line 39.

The Witness: Page 1, Column 1. Oh, yes. "Fig. 3 (749) is a view of a broken specimen, showing the laminated or stratified character of the structure as indicated by the splitting of the body."

Q. So Mr. Goessling obtained a lamination effect, is that correct, which he illustrates in Fig. 3? A. Yes.

R. Leonard Hasche, for Defendant—Recalled—Direct

Q. And what did he admix? A. He admixed, I believe, in that example, styrene, and, I believe it was methacrylate.

Q. Are they incompatible? A. Yes.

Q. Do you find any lamination effect in Exhibit D-17 and D-17-A? A. Yes.

Q. Is that a laminated product? A. I would say so, yes.

Q. Will you examine the defendant product, D-42, and tell me whether that is a laminated product or not? A. Yes, it is.

Q. Resulting from what, would you say? A. Resulting from orientation by being injected by an orifice of two incompatible materials.

Q. Of two incompatible materials? A. Yes.

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(750) Q. When acetate-butyrate was brought out, Dr. Hasche, or cellulose acetate butyrate, later known as Tenite 2, was later brought out by the Tennessee Eastman Corporation, you were in their employ at the time, were you not? A. That's right.

Q. Do you remember the year it was introduced in the market? A. I think it was '38.

Q. The sale of acetate or Tenite 1 was already on the market? A. Yes, sir.

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(751) Q. Did you ever have occasion to admix cellulose acetate and cellulose acetate butyrate? A. We only did when we were carrying out our physical tests in cleaning the cylinder in injection of the extrusion machine.

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By Mr. Churchill:

(767) Q. The first is Claim 1, if you will, please, Dr. Hasche. (768) A. That has to do with the process of

producing this strip material in which the two solid phases are set forth, but not identified. In other words, that is broad.

Q. That claim is broader than Claim 2, is that correct?

The Court: Will you please read his answer?
(Record read.)
The Court: Too broad?
The Witness: Yes, that is the broadcast claim. Yes.

Q. Well, it calls for two non-compatible fiber forming materials, does it not, Doctor? A. Yes. Then the second claim is also process—

Mr. Churchill: That is one that is being relied upon here by plaintiff.
The Court: 2 and 7 are relied upon.

A. (Continuing) And that identifies the materials as cellulose acetate and cellulose acetate butyrate.

Q. In all other respects are they the same? A. Yes, I believe so.

Mr. Churchill: So the defendant submits, your Honor, that if Claim 2 is invalid, Claim 1, which is broader, must also be invalid.

A. (Continuing) Then we come to Claim 4, which has to do with an article of manufacture, and there again we have a broad claim without identifying the two incompatible materials.

Q. And under Claim 4 they could be methyl methacrylate (769) and styrene, is that correct? A. That's right.

Q. Such as used in the Goessling patent? A. Yes. Then

R. Leonard Hasche, for Defendant—Recalled—Cross

Claim 5 is an article of manufacture in which the materials are not identified. And that also is broader than—

Q. Claim 7. A. Claim 7, yes.

Mr. Churchill: So that Claims 4 and 5, your Honor, which are article claims, as distinguished from process claims, are broader article claims than Claim 7, which specifies the materials must be cellulose acetate and cellulose acetate butyrate.

We therefore submit that if Claim 7 is invalid, Claims 4 and 5 also are invalid. And in connection with our request for declaratory judgment, we request such declaration.

That is all.

The Court: Have you said anything about Claim 6?

Mr. Churchill: Claim 6 and Claim 3 are not here involved, because they both require—

The Court: Twisting.

Mr. Churchill: —twisting. And our client, Mr. Gould, has not done any twisting.

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(773) *Cross-examination by Mr. Greene*:

Q. Dr. Hasche, how long were you with Eastman? A. About eighteen years. I came with them in 34 and left in March of '52.

Q. What were your different functions during that time, generally? A. I was director of research up to 1943. From then on Scientific Counsel.

Q. I didn't hear you. A. Up to 1943 I was Director of Research.

Q. Do you mean from 1929 to '43? A. That's right.

Q. From 1929 to 1943? A. No, no, '34 to '43.

Q. '34 to '43? (774) A. That's right.

R. Leonard Hasche, for Defendant—Recalled—Cross

Q. Director of Research for what? A. For Tennessee Eastman Corporation.

Q. At? A. Kingsport, Tennessee.

Q. And after 1943? A. Scientific Counsel for Tennessee Eastman Corporation. And at the same time I was also correlating research between Tennessee Eastman and Eastman Kodak of Rochester.

Q. Were you an independent consultant after 1943? A. No, sir.

Q. When were you? A. After I left Eastman.

Q. After 1952? A. That's right. However, during the war I was with the War Production Board, loaned for about a year.

Q. What was the function of the laboratory of which you were director? A. To develop new processes and new materials.

Q. What was the name of the lab, by the way; did you call it anything? A. Research laboratory.

Q. Located at? A. Kingsport.

Q. You say to develop new materials. Did it work as (775) well on the existing materials, Tenite 1 and Tenite 2? A. Yes, improve existing materials and develop new ones.

Q. Did it seek to improve the processes of using Tenite 1 and Tenite 2? A. Yes.

Q. Was its function to enlarge the field of use by the molders and extruders of Tenite 1 and Tenite 2? A. No, it was not. No. That was a separate division.

Q. What was that division? A. That was the Tenite Division that was responsible for developing the uses and working with the molders.

Q. Where was that located? A. At Kingsport.

Q. Was that a lab? A. A laboratory, yes.

Q. And what was that lab called? A. Well, it was part of the Tenite division.

R. Leonard Hasche, for Defendant—Recalled—Cross

Q. Was that part of your domain? A. No, not directly, although I was consulted, we had meetings, research meetings, in which we consulted on plastics, yarn, all the products of the company.

Q. So there was another lab that was directed to expanding the use of Tenite 1 and Tenite 2? A. That's right.

Q. And your lab was directed to the development of new (776) processes? A. New processes, that's right.

Q. Of what? A. Making chemicals, for one thing.

Q. What kind of chemicals? A. Chemicals used by Eastman, acetic acid, butyric acid, acetone, and making dies for both the yarn and for the plastics.

Q. So your job—your laboratory wasn't primarily concerned with Tenite 1 and Tenite 2? A. Well, not with the sale of it.

Q. I know it wasn't the sale. A. No.

Q. You are a research man. I am saying were you primarily concerned with Tenite 1 and Tenite 2, or other chemical products? A. Well, we were concerned with plastics, as well as chemicals—plastics, yarn, film, dyes.

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(781) Q. Did you ever write any articles for publication? A. Many articles, yes.

Q. About how many? A. I should say twenty, at least.

Q. And when we say publication, that means for the chemical or plastics societies, or for trade journals. A. Trade journals and American Chemical Society, American Institute of Chemical Engineers, American Gas Association, American Society of Refrigerating Engineers.

Q. Have you been the inventor, or joint inventor, in any applications for patents? A. Yes, about 80.

Q. About 80? A. Yes.

Q. Eastman does a lot of patenting, doesn't it? A. That's right.

R. Leonard Hasche, for Defendant—Recalled—Cross

Q. About how many patents would you say Eastman has? A. I wouldn't know.

Q. In the thousands? A. Up in the thousands.

Q. Did your reports go to technical sales or technical service? A. No, I do not believe, as a general thing, unless they referred particularly to something that they were interested in. Sometimes they went to Mr. Palmer, if we had some new plastic (782) we were working on.

Q. Well, then, were all your reports that would apply to technical sales, technical service of the Eastman Company, channeled through—other than yourself—Mr. Stone or Mr. Palmer? A. Yes.

Q. You didn't have any communication with— A. With Mr. Palmer?

Q. —anyone except the president and vice-president, as I understand it? A. Oh, I had dealings with Mr. Palmer continuously.

Q. And his function again? A. He was director of sales of plastics, plastics sales.

Q. Is he the man who is over Mr. Searles? A. That's right, S. E. Palmer.

Q. Are you in the habit of reporting any unusual observations for patent purposes? A. Well, we reported more than observations. When we had what we considered a new idea, we wrote it up as an invention memorandum, as I stated before.

Q. Right. Did you ever intentionally mix Tenite 1 and Tenite 2 together and extrude the mix to get a useful product? A. No.

Q. Do I gather then that such mixing as may have occurred of Tenite 1 and Tenite 2, as done by you, was done in connection (783) with the purge operation only? A. Yes, or accidental.

Q. When you purged did you take off the screens or open the die head? A. No.

R. Leonard Hasche, for Defendant—Recalled—Cross

Q. Did you ever clean the screens? A. We have.

Q. During those operations? A. We have.

Q. But you switched from one to the other by simply running along without changing or cleaning? A. That's right.

Q. Did you have trouble with contamination then? A. Oh, yes.

Q. Some of the molders here have testified that they may have purged, but they always took off the head and cleaned the screens out, and breaker plate, before they went ahead. You didn't do that. A. Well, as I recall some of the testimony, they did not.

Q. But you didn't, anyway? A. No, not as a general thing.

Q. I didn't ask that, I said did you do it? Now, did you take out the die head, and the screens, and the breaker head when you would clean them up, when you would change from one material to the other? (784) A. No. I thought you meant when you clean the machine. No.

Q. Did you ever keep any samples of the purge material? A. No.

Q. Did you ever make any reports on it? A. The reports were all made in conferences.

The Court: But you did make them then?
The Witness: Yes.
The Court: In conference only.
The Witness: Oh, yes.

Q. What did you do and say, and when: give me your version of what happened when you made such reports. A. The report was made, if you would call it a report, when I was talking to the superintendent of the Tenite division, and Mr. Stone, the manager in the offices over in the Tenite division, we were discussing early when we in-

troduced Tenite 2 that they should not be mixed. And I think Carl Malm of Rochester, who was the developer of the mixed esters, was there at that meeting.

Q. Is that the basis for the warning in the Eastman book that we have referred to here, the pamphlet, the caution against mixing Tenite 1 and Tenite 2? A. Yes; the result of these conferences, yes. I wouldn't say that I was solely responsible for that.

Q. Is the effect of what you said to them—I confirm, (785) and be sure to warn your customers not to mix Tenite 1 and Tenite 2, because you get contamination? A. I didn't say to warn the customers, that followed.

Q. I know that. The effect of it, I say. A. That's right.

Q. Was there anything else that you said in that respect? A. I think not, no.

Q. Was there any written reports on that? A. No.

Q. Was there any reference in any article that you ever wrote, or ever saw, on this phenomenon? A. No, no.

Q. Any mention in any patent that you ever know of? A. Well, some of these patents we have discussed refer to mixing.

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(787) Q. Is this object I hand you a spinneret?

(Article handed to the witness.)

A. Yes.

Mr. Greene: I ask that this be marked, a common, ordinary spinneret of commerce.

Q. Do you agree with my characterization? A. Yes, that is one type of spinneret.

The Clerk: It will be marked P-41.

(Received and marked Exhibit P-41.)

R. Leonard Hasche, for Defendant—Recalled—Cross

Q. Also, I hand you a bottle, and I ask you, does that look to you like the plastic dope that they use to extrude through a spinneret to form a filament? A. It appears to be.

Q. Or one of them? A. Yes.

Q. I know that you can't chemically analyze it, but you can see it and see how it flows.

Mr. Greene: Will you mark this Plaintiff's Exhibit 42.

The Clerk: P-42.

(Received and marked Exhibit P-42.)

Q. So that we may all be clear in our discussion, is it proper to say that filaments, or the basic filament that is (788) twisted to form threads is made by pressing this type of plastic dope, contained in P-42, through a nozzle, such as P-41, a spinneret, which has many tiny openings in it, so that you get the threads, the filaments extruded through the spinneret? A. That's one type of spinning.

Q. It is hard to see the openings in that spinneret, you may or may not be able to see them, because they are very small, but they are there; am I correct, Dr. Hasche? A. Yes, you are.

Q. And I believe it is fair to say that a great proportion of textile fibers are made by pressing a dope, a viscous, jelly-like dope like this, with a varying amount of solvent and plasticizer, through spinnerets which contain many holes to get a bunch of little threads which may be then twisted together. That is what most of these things are made of in synthetics? A. Except nylon.

Q. Explain nylon. A. Nylon is spun from a molten form through a spinneret, or, if they make a monofil, through a larger orifice, single orifice. For instance, in

making tooth brush bristles, or things of that sort, they have a larger orifice, and a single orifice.

Q. What is it they extrude out, what is the nylon base (789) material? A. Well, there are several nylons. One of them is hexamethylene diamine and adipic acid. Those two are combined to form—

Q. Is there reaction between the two? A. Yes, it's a condensation, splitting water out.

Q. At any rate, there is no cellulose derivative in nylon? A. No.

Q. How much is nylon stretched in the making? A. About four or five hundred per cent.

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Q. In the reports that you made there were no written reports at all involved, it was only oral reports? A. That's right, discussions.

Q. And that was for the purpose of insuring the proper use and not the mishaps in use by the users of Tenite 1 and Tenite 2? (790) A. That's right.

Q. Did you tell either of these people, or did you write down anywhere that—I have observed a new phenomenon when Tenite 1 and Tenite 2 are mixed? A. Well, I wouldn't say it was a new phenomenon. It was a phenomenon that you always get when you mix two things which are incompatible.

Q. New or old, did you ever tell it to anybody, that—I saw this and this is a matter of information, that when you mix these two together you get this result, that might have a use somewhere? A. Well, I certainly knew that it would have a use in making a laminated material. In other words, in positive molding we—much before that—would mix two materials which would give a laminated material, mica-like structure.

R. Leonard Hasche, for Defendant—Recalled—Cross

Q. I have here a piece of mica—agreed, is that mica? A. That's mica.

Mr. Greene: Will you mark this Plaintiff's Exhibit 43?

The Clerk: P-43, piece of mica.

(Received and marked Exhibit P-43.)

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(791) Q. That is the fact, isn't it, this separates layer-wise; mica is not a fibrous material, is it? A. Yes, I would say it was a fibrous material.

Q. Well, would you say— A. A fiber doesn't—it may be fibrous, and the fibers may not be aligned, but it has a fibrous structure.

Q. Well, would you say that mica is generally referred to as being a lamellar structure or fibrous material? A. It is lamellar. I might say asbestos is fibrous, but it can be pressed into the same kind of a thing as that.

Q. Well, could you press asbestos so that you get solid, continuous lamellar structure? A. Not exactly like that, but it would have some of the physical properties of that.

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(798) The Witness: The word "fibrous" is throughout the patent literature. All these things—the final product that Mr. Seckel got is substantially the same as some of these things here, except they are made a different way.

By Mr. Greene:

Q. That's good. Now it is throughout the patent literature. Is it anywhere in the patent literature when applied to a product consisting of cellulose acetate and cellulose acetate butyrate? A. You don't ordinarily record things unless they have some use for them in patent literature.

The Court: Well, that is his answer. In other words, there being no use for it, it would never be recorded, is that right?

The Witness: That's right.

Q. Well, at least it was an interesting phenomenon, wasn't it? A. You don't record extraneous things in patents.

Q. Do you record interesting phenomena? A. Not ordinarily, you do not, in patents.

• • •

(800) The Witness: If you ever go to the Tenite division in Kingsport, there is an enormous sign says, "Do not mix Tenite 1 and Tenite 2." An enormous sign.

The Court: Is it still there?

The Witness: Still there.

Mr. Greene: Let me mark this for identification as Plaintiff's Exhibit 44.

The Clerk: P-44 for identification, a split rod.

(Marked Exhibit P-44 for identification.)

• • •

(801) Q. Will you describe what P-44 for identification is? A. I'd say this is a fibrous structure.

• • •

Mr. Greene: I would like to mark this in evidence because it is simply the same Bonar strip as we have had before, but it has been pulled apart to show how it acts.

Q. Is there any reason that you can think that it isn't (802) a Bonar structure? A. No.

Mr. Churchill: Is there anybody here who said, "I did it."

R. Leonard Hasche, for Defendant—Recalled—Cross

Mr. Greene: If you want me to put witnesses on, Mr. Seckel will say, "I did it."

Mr. Churchill: And when; how long did it take him to do it?

Mr. Greene: He just did it a week ago.

Mr. Churchill: How long did it take him to do it?

Mr. Greene: How long did it take you to do it, Mr. Seckel, to pull this apart?

Mr. Seckel: May I see this particular piece?

(Article handed to Mr. Seckel.)

Mr. Seckel: To separate that?

Mr. Greene: Yes.

Mr. Seckel: A few minutes.

Mr. Churchill: With a knife?

Mr. Seckel: No, just by pulling it by hand.

The Clerk: P-44, formerly marked for identification, now marked in evidence.

(Received and marked Exhibit P-44.)

The Court: Have you observed many times, Dr. Hasche, combinations of incompatible materials resulting in a fibrous structure of that kind?

(803) The Witness: I have.

The Court: Aside from this acetate and butyrate involved here?

The Witness: Yes.

The Court: Many times?

The Witness: That's right. I wouldn't say many, I'd say three or four times.

By Mr. Greene:

Q. Where and what materials? A. Well, the materials that we were making were presumably co-polymers, when we got this. We were making rods and when we got this

structure, why, we found that they were not two co-polymers. I gave one example in my early testimony.

The Court: Yes, I recall it.

Q. Were those rods ever actually made and sold? A. No.

Q. Were they ever patented? A. No.

Q. What was the fate of the rods, simply that you tried it, and it didn't come out so good, so nothing happened? A. That's right. As I said, I showed it to the president of the company one day, took it over and showed it to him, and said, "This is a rather interesting structure."

The Court: Since you couldn't see any useful purpose for it, you never recorded it.

(804) The Witness: No.

Q. Are any of your observations that you refer to here something again that we could put our fingers on now, are they in the literature, in patents, in commercial production? A. Not that I know of.

• • •

(806) Q. By the way, in the description of this product itself, if you were describing the inside structure of this product in suit P-44, how would you describe it? A. I would describe it as a strip of material containing oriented filaments which are in the molding, or coalesced into a unitary structure, which, in bending, can be broken into its components.

Q. Would you agree that the inside structure comes about because individual granules of Tenite 1, Tenite 2, are softened by heat and squeezed through an extruder so that they extend into filament form? A. Well, that's a fairly good description.

R. Leonard Hasche, for Defendant—Recalled—Cross

Q. So that the final product is, in effect, a strip or a rod containing an endless number of tiny filaments which emerge or were formed from one or two granules and which are separated from the one next to it because they don't get along, they are incompatible? A. Well, that is one mechanism.

Q. Is that a reasonable way of putting it? A. Yes.

Q. I don't want to review the patent with you (807) individually. Let me just put it this way, is there any patent there that shows mixing cellulose acetate and cellulose acetate butyrate and extruding them to make a fibrous material? A. No.

Q. Is there any patent there which teaches mixing of two incompatible materials and extruding them without substantial stretching to get a fibrous material? A. Well, the Carothers patent, I would say the stretching comes later.

Q. Carothers puts it out through a spinneret, doesn't he? A. That's right.

Q. He forms his fibers because his dope squirts through holes? A. He doesn't use dope, Carothers doesn't use dope.

Q. Well, he uses what, a molten plastic? A. Yes.

Q. He forms a fiber because it comes out through a hole, doesn't he? A. That's right.

Q. Each fiber comes out and is formed by a hole. A. Each filament.

Q. Each filament, of course, comes out and is formed by the hole? A. Yes.

(808) Q. That is not the same thing as the Seckel patent, is it? A. Well, the product you get—you can get the same product by it. It is not the same way of making it.

Q. Could you get this product by using Carothers? A. Look at Dreyfus here. It is artificial straw, which is the same sort of a thing.

R. Leonard Hasche, for Defendant—Recalled—Cross

Q. Before we go to Dreyfus, on this Bonar strip here that we are talking about, could Carothers make this Bonar strip in the way that we talk of in the Seckel patent; could he extrude it through a single orifice? A. Sure.

Q. A single die opening? A. Sure.

Q. Where does he say that? A. That's the way he makes monofils.

Q. Where does he say that in his patent? A. He didn't say that—

Q. Well, I am only saying what he says in his patent that we are talking about, not somewhere else. A. He says a nozzle up here, and he says a spinneret down in the—in the two references I quoted from before—he says nozzle in the first one and spinneret in the second one.

Q. He says a fine nozzle or spinneret, doesn't he? A. Yes.

(809) Q. Isn't that what you are reading? A. That's right.

Q. Page 7, column 1, at the top? A. That's right.

Q. Don't you think he means a fine nozzle or spinneret, the same thing? A. Carothers recognized the use of his material in making toothbrush bristles. He doesn't limit it to spinneret.

Q. Does Carothers say in that patent that we are talking about that he could send out of a single orifice two materials which would get together and form a strip, or does he send them out through tiny nozzles or orifices, and then do what he wants later? A. Well, I said before that none of these patents show the same method that Seckel used.

Q. And by "same method" can we say, for brevity, that none of the patents show taking two incompatible materials, mixing them thoroughly, squeezing them out through an extruder, in a single nozzle extruder, so that the final product is a material which when flexed, or worked,

you can tell consists of a vast number of filaments? A. None of them are like the Seckel patent, no.

• • •

(815) Q. What, in your mind, are the best references —I am just trying to shorten the thing—is it not a fact that many of the references discuss and teach conventional processes of extruding dope of one kind or other, as in P-42, through a spinneret of one kind or other, such as P-41, with a great number of tiny orifices to make a filament? A. Those are the processes involved, largely, yes.

Q. Which other of these patents now would you consider to be close enough so that we should go into them? A. Well, of course, the Dreyfus patent shows a synthetic straw, which is—

Q. Just a moment. Give me the number, will you? A. 2,050,286.

Q. Yes. And how does he do it? A. He makes filaments of various yarns and then he coalesces them. Notice on page 1, column 1, lines 38, and following, "The filaments or yarns or other materials to be coalesced may be drawn from bobbins or other suitable packages to be treated by our process, or they may be drawn directly from the spinning machine where they are produced."

Q. Is it a fact that this Dreyfus patent, 2,050,286 (816) teaches taking a number of filaments already made, softening them, and pressing them together to form a bundle or straw? A. That's right. I say the product is similar but the process of making them is different.

Q. He makes it by making a bunch of filaments, as through a spinneret, and then softening them, and then packing them together. A. Either spinneret, or they have already been made.

Q. One way or the other? A. Yes, they may be a natural product.

R. Leonard Hasche, for Defendant—Recalled—Cross

Q. You don't have a sample of that product, do you? A. No.

Q. Any other patent? A. We have already discussed the Goessling patent, which is, of course, extrusion into a cavity.

Q. Well, that is injection molding, isn't it? A. Injection molding, yes.

Q. And there you injection mold a plastic into a cold confined cavity? A. That's right. But in the sprue you have the same sort of a thing as you do in extruding.

Q. Does the Goessling patent talk about the sprue? A. No, but he has to have one.

Q. I see it there. There is a sprue there. I mean (817) does he disclose or teach anything about what happens in the sprue? A. No.

Q. What happens to the sprue ordinarily when you injection mold? A. It is broken off.

Q. And then what? A. Well, it can be reused, the material.

Q. Well, the sprue is not a part of the final product? A. No.

Q. It is taken off, broken up and probably reground into the mass again? A. That's right.

Q. He doesn't say anything about what happens in the sprue in the patent. A. No.

Q. Is Goessling making a pearlescent material like we saw on Exhibit P-36A—this is P-36A and B—does A look like Goessling should look? A. Yes, I'd say so.

Q. Would A have any physical relationship to the Bonar strip? A. Well, the similarity is that you have two separate phases there.

Q. But this P-36 would not be a fibrous body, would it? (818) A. No, not the way it's been molded.

Q. Well, in the bottom, B, its been extruded; is that a

fibrous body, do you think? A. It is too large a rod to tell very much about it.

Q. You can't say then? A. No.

Q. But the function, the purpose of the Goessling patent was to make a decorative, pearl-like plastic, as seen in P-36A? A. Yes.

Q. What Goessling made wouldn't be in the same field or for the same customers, or for the same use as Bonar, would it? A. Not if made by his method, no.

Q. Any other patent you think is pretty close? A. Well, I think I have discussed all of them, and I don't —

Q. You have, and I am not saying they are not pertinent at all, I just want to know which ones are close. A. Of course, taken together, they all show a bundle of fibers that are oriented— I mean that form a fibrous product.

Q. Do any of them show making a rod or strip that is a bundle of fibers from a single orifice without a substantial stretch? A. No, I don't think so.

Q. Well, then, the Seckel process is different, isn't it? (819) A. Well, the process I wouldn't say is any greatly different than the Goessling, except he has a cavity on it.

Q. Well, do you think that Goessling is making a fibrous product? A. If you took the cavity off.

Q. You mean if you didn't inject the mold? A. Yes.

Q. Injection molding is what he discloses. A. Yes, but the only difference is he is pushing his material into the cavity instead of pulling it out free.

Q. What you are saying, am I correct, is that if he did something else he would then teach the Seckel patent? A. Well, he does go through extrusion in his process, to the sprue.

Q. You are speaking now of the sprue? A. That's righ .

Q. Does he say anything about it in his patent? A. No. Anyone skilled in the art knows that, though.

Q. Well, I know, but we have a patent here, and we are going on now not common knowledge but what is in the patent. A. I wouldn't see any purpose in saying anything about it.

Q. Because nobody ever uses the sprue, is that correct? A. That's correct.

Q. Goessling doesn't say he could also do this by extrusion, does he, in his patent, or in the alternative? (820) A. No.

Q. So, so far as what Goessling actually says in his patent, does he teach the method of the Seckel patent? A. He teaches a method of mixing two incompatible materials and putting them through a small orifice.

Q. Well, you know my question and I wish you would try to give a yes or no, if you can. I said does Goessling in his patent disclosure teach the Seckel process, which you understand? A. Not the same, not exactly the same.

Q. Any other patent that seems close to you? A. Well, I believe not anything to say beyond what we have said.

Q. Isn't it pretty fair to say that the rest of the patents pretty much show filament forming of one material or the other through tiny orifices, such as spinnerets? A. Yes.

The Court: I note here in the Goessling patent, 457, column 2, line 51, he says, "Instead of an injection mold, an ordinary compression mold may be used."

The Witness: Yes.

The Court: What is a compression mold?

The Witness: A compression mold is a positive molding. In other words, they have a mold and they charge material into it and press it, press down on it.

(821) Mr. Greene: Your Honor understands that it still goes into a cavity. It is the old way of

molding before they got injection. It is still not anything like extrusion. It presses into a cavity.

The Witness: There is some flow, however, in positive molding.

Q. There is always a flow in molding, isn't there? A. Oh, yes, but—well, I mean when you come down—in other words, if you have two incompatible materials and put them in a positive mold, you will get laminations.

Q. Like Goessling. A. No, different than Goessling. You get material that will strip off, like mica, a mica type, laminated.

The Court: It will scale off.

The Witness: That's right.

Q. You said before that mica would be a fibrous material as well. Will you see if you can get a fiber from it, or what you call a fiber.

(Article handed to the witness.)

A. You can disintegrate this and get a fibrous structure.

Q. Well, would you show me just that, show me a fiber there. A. You mean a long fiber?

Q. A fiber. A. Well, I don't think I can by hand this way, but it's (822) considered fibrous.

Q. But you couldn't get a fiber from it right now, you would get a flake or a lamellar piece, isn't that correct, with what you can do now? A. That's right.

The Court: Is this considered fibrous, this piece of mica?

The Witness: Yes, it is considered a fibrous structure.

Mr. Greene: Your Honor, whenever you go like this with this kind of stuff (indicating)—in our stuff,

if you recall, we said fibrous—when you go like this, it goes like this (indicating), it flakes, it scales. And that is what I was making the point of here.

The Witness: In other words, that has probably been made geologically by asbestos being molten and under high pressure.

* * *

(823) Q. In this Seckel patent he talks about the first step in mixing. Do you agree that it is necessary to mix the granules in order to get a useful, salable structure, such as the plaintiff and defendant make? A. Yes, it should be mixed well.

* * *

Q. And that goes back to the characterization that I (824) think you agreed with before, that when mixed well each granule, or couple little granules, of Tenite 1 and Tenite 2 are sitting next to each other, squeezed out when soft into a filament, and then lie there side by side because they are incompatible, capable of being later flexed and assuming a fibrous appearance at that time. A. Well, that is a good characterization, I think.

The Court: Two incompatibles can never mix, is that right?

The Witness: Yes, if they are incompatible.

The Court: They can never mix.

Mr. Greene: They sort of stick together, though, you know.

The Court: Yes, I know what you mean.

The Witness: Well, I would qualify that somewhat. You can disperse things fine enough so that they appear to, for instance, in an emulsion. Emulsion is oil and water mixed perfectly so that they look to be homogeneous, they do not settle.

The Court: But they are, in fact, not mixed.

The Witness: They are not mixed.

Mr. Greene: That's right, they appear to be mixed, but they are really not, no matter how fine down you go.

The Witness: That's right.

* * *

(829) Q. You referred to Mr. Malm as the man who who had developed cellulose acetate butyrate, is that correct? A. Yes.

Q. Did he ever make known to you, or others, any work which he had done in mixing cellulose acetate and cellulose acetate butyrate? A. Oh, yes, when he came to Kingsport with the proposal that they put out Tenite 2 he informed them that they were incompatible. Malm is from Rochester, in the chemical department, manager of the chemical department there, and he works mostly on making film, and making dopes for spinning, but when he worked out the acetate butyrate, the mixed esters, he found that they were superior in that they took less plasticizer than Tenite 1 and, of course, that led to all this work on plasticizers. We found that we had to use different plasticizers for the two plastics. But Malm early told the management that they were incompatible. He found that out in making film.

(830) Q. And being incompatible, what would happen? A. Well, they wouldn't form a homogeneous mass.

The Court: Now, is that the same Carl J. Malm that is mentioned in this patent 376?

The Witness: Yes, your Honor.

Q. Can you tell by looking at Plaintiff's Exhibit P-42 what it consist of, chemically? A. No. It's a dope, that is all you can tell.

Q. Is its viscosity of somewhat the same nature or different from the nature of the cellulose acetate when it is in the extruder? A. Well, I don't know that. I would say cellulose acetate is more viscous than that.

Q. In other words, the cellulose acetate in the extruder is more flowable than this dope, P-42. A. No, I wouldn't say so. I wouldn't think it was quite as fluid as that.

Q. It isn't quite as fluid? A. No.

Q. But the cellulose acetate is fluid at the time it is extruded? A. Yes, it is softened.

Q. Molten, softened. A. Yes.

The Court: I thought it came out more like taffy.

(831) It doesn't come out in liquid form, does it?

The Witness: No.

Mr. Churchill: This is not liquid.

The Court: It isn't?

Mr. Churchill: At least it doesn't flow.

The Witness: It flows very slowly.

Mr. Churchill: This is like molasses.

The Witness: That is a very high viscosity dope.

The Court: Yes, I see it. I had the wrong impression when I first looked at it.

Mr. Churchill: That is all.

Recross examination by Mr. Greene:

Q. For the clarification of that, when a dope comes out of a spinneret, that you saw there, it is in a semi-solid state on emerging, enough to hold its form, is that correct? A. Yes.

Q. Is it also correct, generally, to say that it is then more solidified or hardened by either air, or a reacting bath, so that you get a finished thread or filament? A. Yes.

Q. Right? A. Yes.

• • •

Q. Are cellulose acetate and cellulose acetate butyrate
(832) compatible when they are heated? A. No.

Q. They are no more compatible hot or cold, are they? A. Well, of course, you can't tell whether they are compatible cold unless you put them in solvents.

Q. They are not compatible in any form. A. No.

Q. Well, is it true that the extrusion device is like a meat grinder of common knowledge? A. The only thing is you soften the material in the extrusion press by heat.

* * *

(833) Q. Is Tenite 1 ever used to make filaments by a spinneret process? A. We don't call it Tenite 1, we call it cellulose acetate.

Q. I am aware of that, but is it Tenite 1 in form? A. No, no.

Q. They use a cellulose acetate dope for that, don't they? A. That's right, no plasticizer.

* * *

Plaintiffs' Exhibit 1

Nov. 21, 1950 P. H. SECKEL **2,531,234**

LONGITUDINALLY SEPARABLE EXTRUDED THERMOPLASTIC STRIP AND PROCESS OF PRODUCING SAME

Filed July 21, 1949

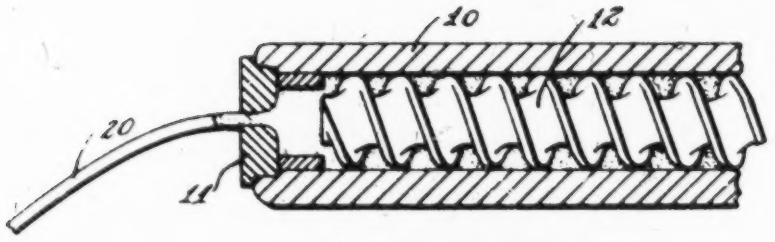

FIG. 1.

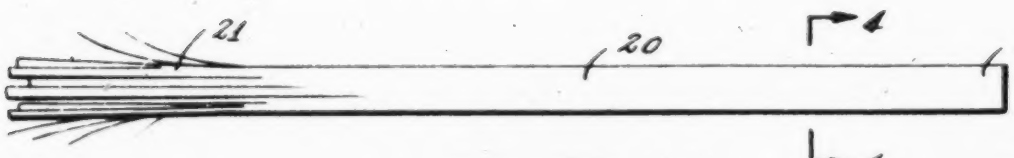

FIG. 2. FIG. 3.

FIG. 4.

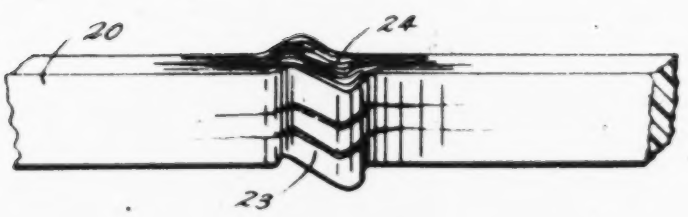

FIG. 5.

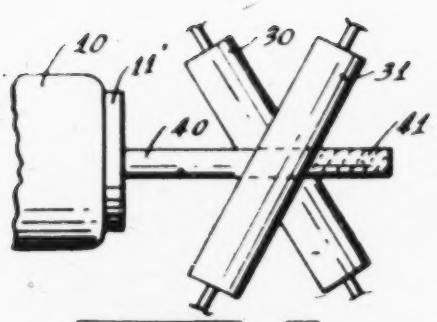

FIG. 6.

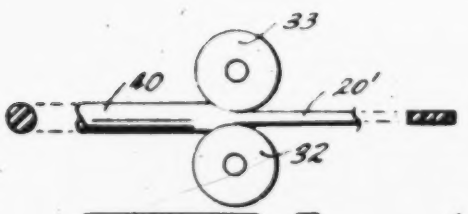

FIG. 7.

INVENTOR.
PETER H. SECKEL

BY Greene & Dorr

ATTORNEYS

Plaintiffs' Exhibit 1

Patented Nov. 21, 1950 2,531,234

UNITED STATES PATENT OFFICE

2,531,234

LONGITUDINALLY SEPARABLE EXTRUDED THERMOPLASTIC STRIP AND PROCESS OF PRODUCING SAME

Peter H. Seckel, New York, N. Y., assignor to Richard A. Fisch, New York, N. Y.

Application July 21, 1949, Serial No. 105,937

7 Claims. (Cl. 18—47.5)

1

This invention relates to a novel process of making continuously extruded products of plastic material and to the extruded products of plastic material made by the process.

An object of the invention is to provide a length of extruded material which has unusual longitudinal tensile strength and unusual resistance to shear or tearing transversely with respect to the direction of extrusion.

Another object of the invention is to provide a length of extruded material which is easily separable into threads which run parallel to the length of the extruded material.

Another object of the invention is to provide a length of extruded material which is easily separable into threads which run spirally with respect to the length of the extruded material.

Another object of the invention is to provide a length of extruded material which has a very high resistance to breaking as a result of repeated flexing.

Another object of the invention is to provide a process of making such a length of extruded material.

It has been known for some time that the extruded products formed from a crystalline type of plastic material have a preferred orientation in the direction of extrusion. Such extruded products are more resistant to tearing transversely than longitudinally but such products are not separable into threads. In other words the micellar alignment of the crystal particles have only a slight preference in the longitudinal direction. It has also been proposed to stretch a preformed film of crystallizable plastic material several hundred percent and then produce threads from the film by rubbing the film transversely to cause it to split into filaments. In this latter case a very great stretch is necessary.

It is an object of the present invention to produce a product which is completely separable into threads or smaller filaments without requiring the added stretching step.

These objects and other ancillary thereto are obtained by adding two or more incompatible thermoplastic, fiber-forming linear-polymeric compositions to an extruding machine and extruding the two materials to form a unitary product.

At least two of the thermoplastic materials which are extruded must be fiber-forming material (i.e., they must be of the type which are capable of giving an X-ray fiber diagram when formed into a thread and stretched) and must be incompatible. Apparently any two of such fiber-

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forming thermoplastic materials that are incompatible can be employed although it is obvious that the plasticizing temperatures of the two materials should not be too far apart. The proportions of the incompatible materials are not very critical, the proportion of either one can vary from about 5% to 95% or more, of the mixture. The best mixture so far found is 40-60% of cellulose acetate with 60-40% of cellulose acetate butyrate.

The extruded products may have any size from that of textile filaments to large strips or rods. The cross sectional shape of the product can also be varied to suit the application to which the product is to be put. The thin strips are very useful as corset stays and similar stiffening reinforcements for ordinary or protective wearing apparel or in any material which is apt to be subjected to repeated flexing. The mix may be extruded as a rod and twisted to cause the fibrils to extend spirally. The twisted rod may be subsequently flattened.

Various additional ingredients may be added to the mixture as desired. The thermoplastic materials may contain plasticizers and/or pigments, dyes, lubricants, additional plasticizers, etc. may be added to the mix as desired to regulate the color and appearance of the product.

The novel features characteristic of this invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of specific embodiments when read in connection with the accompanying drawings in which:

Figure 1 is a diagrammatic view illustrating how the product is produced.

Figure 2 is a side view of a length one type of the extruded material showing at one end how the structure can be separated into fibers.

Figure 3 is an end view of the strip of Figure 2.

Figure 4 is an enlarged end view showing diagrammatically the thread-like structure of the strip.

Figure 5 is a view showing what happens when a strip similar to that of Figure 2 is repeatedly flexed.

Figures 6 and 7 illustrate a method of making a product with a spiral thread structure.

As illustrated in Figure 1 the mix comprising two incompatible thread forming thermoplastic materials is extruded through the die 11 of the extruding machine 10 to form a strip 20. The

mixture can be forced through the die 11 by any of the ordinary extruding means such as the screw means 12. As shown at the end 21 of Figure 2 the strip 20 can be separated longitudinally into a plurality of threads or filaments. Figure 4 shows diagrammatically how the strip can be separated into threads by applying friction to the end 22' of the strip.

Figure 5 illustrates what happens when a strip made according to the process of Figure 1 is repeatedly flexed back and forth sharply at one transverse area about an angle of almost 360°. The outside surface usually adheres transversely to form a bulging film 23 at the side of the strip. The inner layer of the strip however gradually separates into increasing numbers of thin threads or filaments 24 as the flexing is continued, and the cross-sectional area of the strip increases at the bending area due to the fact that the separated threads are interspersed with air spaces. However, the intermediate layer of threads 24 do not rub against each other or cause abnormal tension to be exerted on any particular area so that the strip will withstand an unusual number of such severe flexings without separating.

The threads may be made to run spirally or non-linearly with respect to the extruded length by a process such as illustrated in Figures 6 and 7. The non-homogeneous mixture of thread forming thermoplastic materials is extruded from the extrusion press 10 through a die 11' which produces a strip or rod 40 of round cross section. The round extrusion product 40 is passed between angled rollers 30, 31 while still plastic so as to twist the extruded product. The twisted rod 40 is cut when the end 41 thereof is so far past the rollers 30, 31 as to tend to untwist. Any method may be employed for twisting the rod 40. The cut lengths of twisted rod are then passed between flattening rollers 32, 33 to produce the strip material 20'. The product shown in Figure 7 separates into threads also when repeatedly flexed but the product is more resistant to splitting than the product of Figures 2-4 because the threads at one of the flat sides of the strip 20 run at an angle to the threads at the opposite side. The outside layers of the product of Figures 6 and 7 is twisted more and is more fibrillar or more easily separated into fibers than the inner layers.

The following example illustrates how the process is carried out.

Example

50 lbs. of commercial cellulose acetate molding powder having a particle size of about ⅛-¼" in diameter are mixed with an approximately equal amount of commercial cellulose acetate butyrate molding powder of approximately the same particle size. As stated above the ratio of the amount of the two powders is not critical. ½ lb. of a pigment such as titanium dioxide is added and the mechanical mixture is introduced into the hopper of a continuous extrusion machine such as shown in Figure 1. The extruded strip has the properties of the strip shown in Figures 2-5 of the drawing. The strip separates substantially completely into threads, i. e., there is no visible portion of the strip which separates into non-fibrous material.

I claim:

1. A process of producing strip material which has a homogeneous appearance but separates into a plurality of filaments when sharply bent comprising the steps of mixing two non-compatible, fiber forming, linear-polymeric, thermoplastic materials, plasticizing said mix, and forcing the mix containing two separate solid phases through a single orifice die and withdrawing the extruded product from the die without substantially stretching the same whereby a unitary product consisting essentially of two distinct series of parallel threads adhered together is obtained.

2. A process of producing strip material which has a homogeneous appearance but separates into a plurality of substantially parallel filaments when sharply bent comprising the steps of mixing cellulose acetate with cellulose acetate butyrate which is non-compatible with said cellulose acetate, plasticizing the mix, and forcing the mix containing two separate solid phases through a die, one phase of said mix comprising a solid fiber-forming material consisting essentially of cellulose acetate and the other phase comprising a solid fiber forming material consisting essentially of cellulose acetate butyrate.

3. A process of producing strip material which has a homogeneous appearance but separates into a plurality of substantially parallel filaments when sharply bent comprising the steps of mixing two non-compatible, fiber forming, linear-polymeric, thermoplastic materials, plasticizing said mix, and forcing the mix containing two distinct solid phases through a die with a circular orifice to form a rod and twisting the extruded rod as it is formed and while it is still in a plastic state and thereafter heating and flattening the twisted rod whereby a unitary product consisting essentially of two distinct series of spirally arranged parallel threads which are adhered together is obtained.

4. As an article of manufacture, an extruded longitudinal strip of thermoplastic material, having a homogeneous appearance but actually comprising two chemically distinct solid phases, each of said phases consisting essentially of a fibrillar, linear-polymeric, thermoplastic material which has a similar melting point but which is incompatible with the thermoplastic material of the other phase even when melted, the linear alignment of the individual fibers of each of said thermoplastic materials being substantially parallel and said strip having a substantial thickness whereby when the strip is bent sharply at any point the phases separate into a plurality of layers each containing a multiplicity of filaments, said product being substantially unseparable transversely thereof beyond the filamentary stage by any operation involving only the repeated bending of the strip.

5. As an article of manufacture, an extruded longitudinal strip of thermoplastic material, having a homogeneous appearance but actually comprising two chemically distinct solid phases, each of said phases consisting essentially of a fibrillar, linear-polymeric, thermoplastic material which has a similar melting point but which is incompatible with the thermoplastic material of the other phase even when melted, the linear alignment of the individual fibers of each of said thermoplastic materials being substantially parallel to the length of the strip and said strip having a substantial thickness whereby when the strip is bent sharply at any point the phases separate into a plurality of layers each containing a multiplicity of filaments, said product being substantially unseparable transversely thereof beyond the filamentary stage by any operation involving only the repeated bending of the strip.

6. As an article of manufacture, an extruded longitudinal strip of thermoplastic material, hav-

Plaintiffs' Exhibit 1

ing a homogeneous appearance but actually comprising two chemically distinct solid phases, each of said phases consisting essentially of a fibrillar, linear-polymeric, thermoplastic material which has a similar melting point but which is incompatible with the thermoplastic material of the other phase even when melted, the linear alignment of the individual fibers of each of said thermoplastic materials being substantially parallel to an imaginary spiral which passes about said strip and said strip having a substantial thickness whereby when the strip is bent sharply at any point the phases separate into a plurality of layers each containing a multiplicity of filaments extending spirally with respect to the length of the said strip, said product being substantially unseparable transversely thereof beyond the filamentary stage by any operation involving only the repeated bending of the strip.

7. As an atricle of manufacture, an extruded longitudinal strip of thermoplastic material, having a homogeneous appearance but actually comprising two solid phases, one of said phases consisting essentially of cellulose acetate, the other of said phases consisting essentially of cellulose acetate butyrate, said two cellulose derivatives of the two phases being incompatible with each

other and each having a fibrillar structure, the linear alignment of the individual fibrils of each of said cellulose derivatives being parallel and said strip having a substantial thickness whereby when the strip is bent sharply at any point the phases separate into a plurality of layers each containing a multiplicity of filaments said product being substantially unseparable transversely thereof by any operation involving only the repeated bending of the strip.

PETER H. SECKEL.

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The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,185,789	Jacque	Jan. 2, 1940
2,223,376	Malm	Dec. 3, 1940
2,251,962	Sommaripa	Aug. 12, 1941
2,353,457	Goessling	July 11, 1944

OTHER REFERENCES

Bailey: "Plastics Technology," India Rubber World, May 1948, pages 225-231.

Defendants' Exhibit 9A

PATENTEE Goesling

July 11, 1944.

G. A. GOESSLING NO. 2,353,457

SYNTHETIC PEARL RESIN CASE. A. 2

Filed Oct. 7, 1940

Fig. 1.

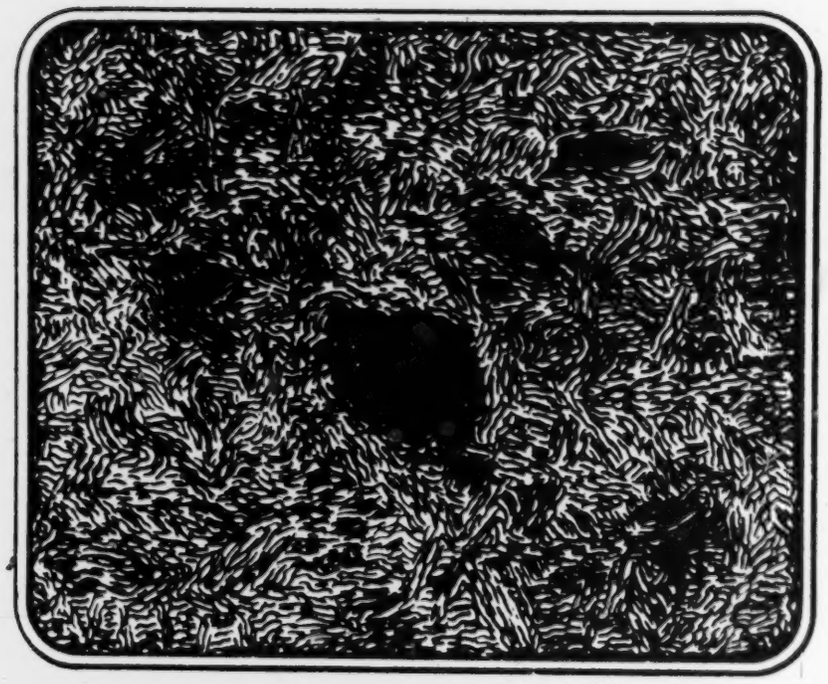


Fig. 2.

Fig. 4.

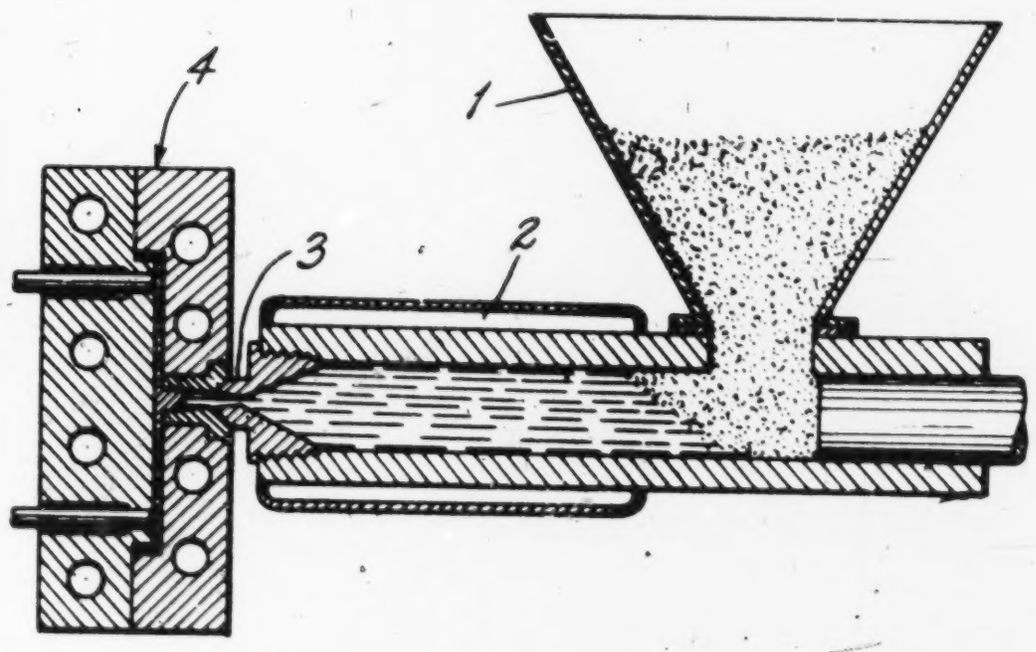
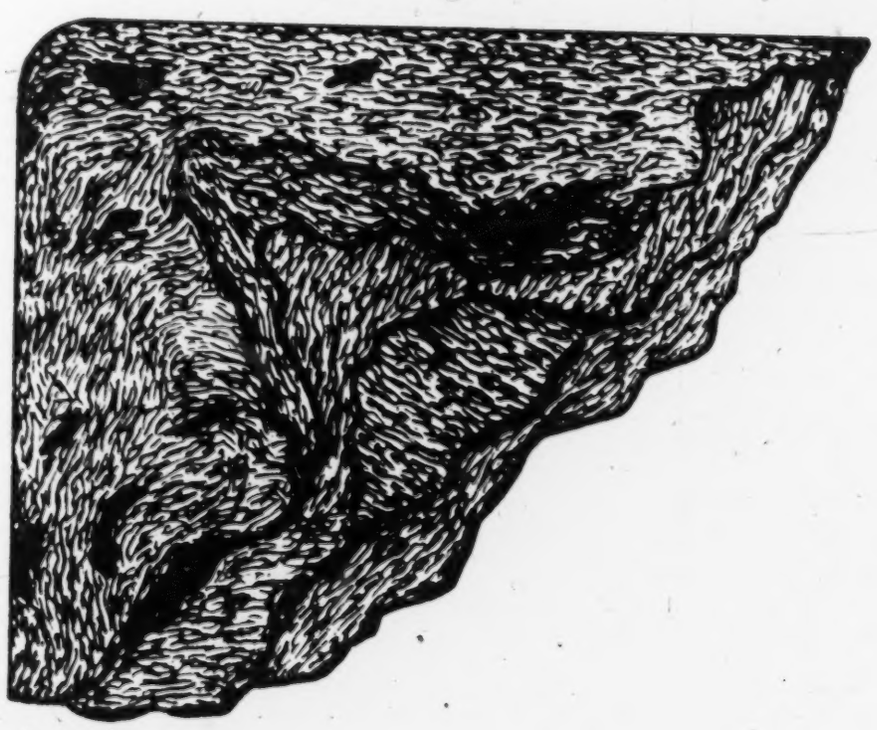
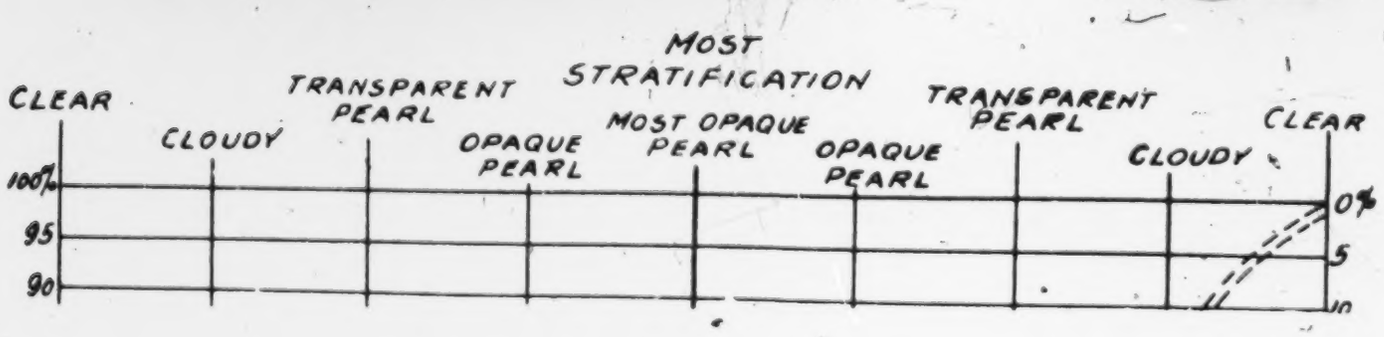


Fig. 3.





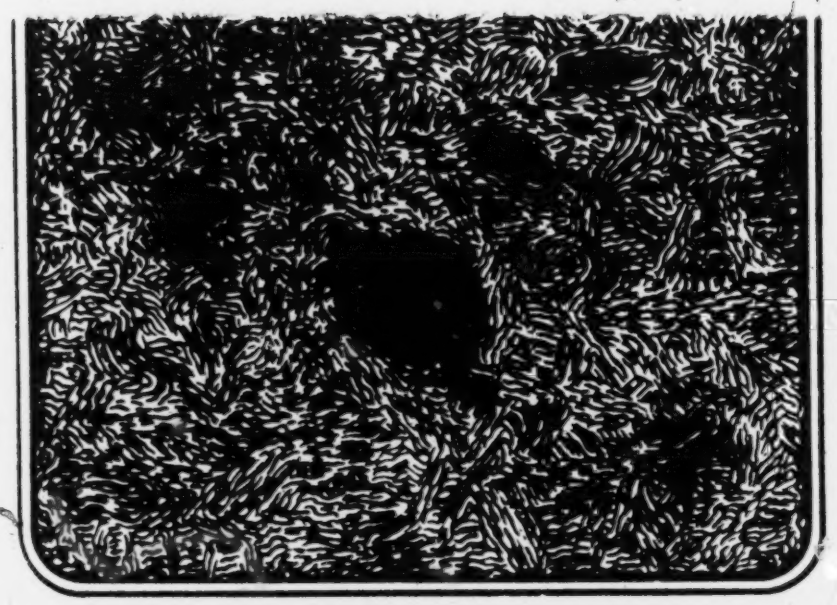


Fig. 2.

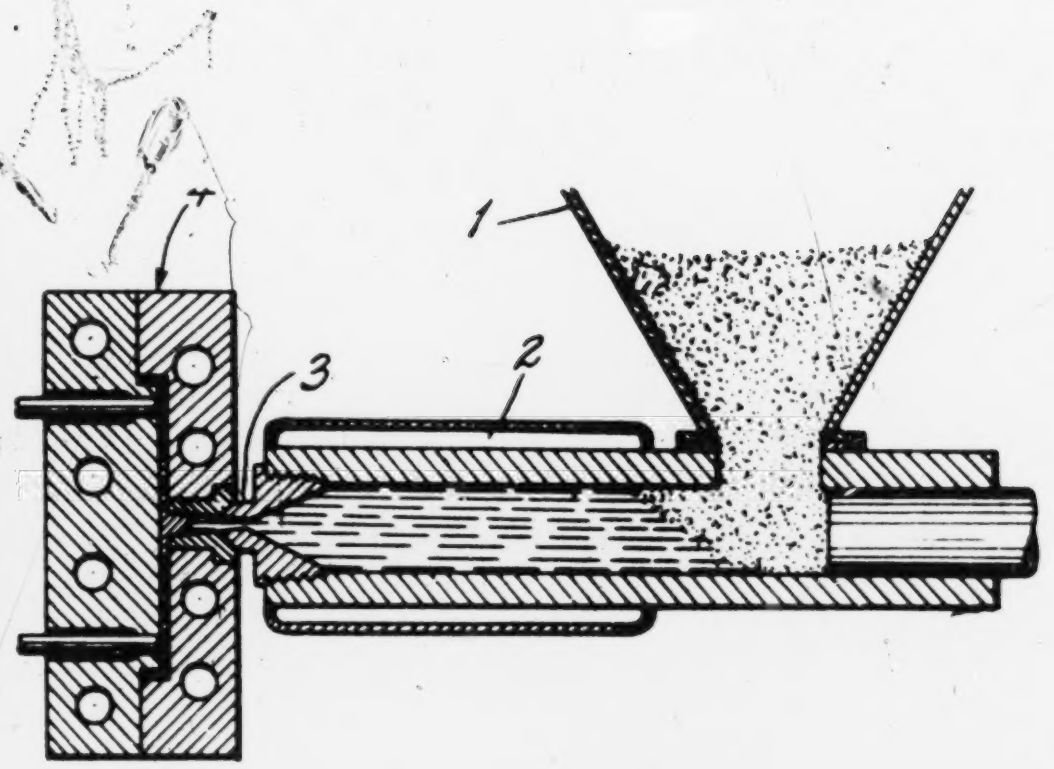
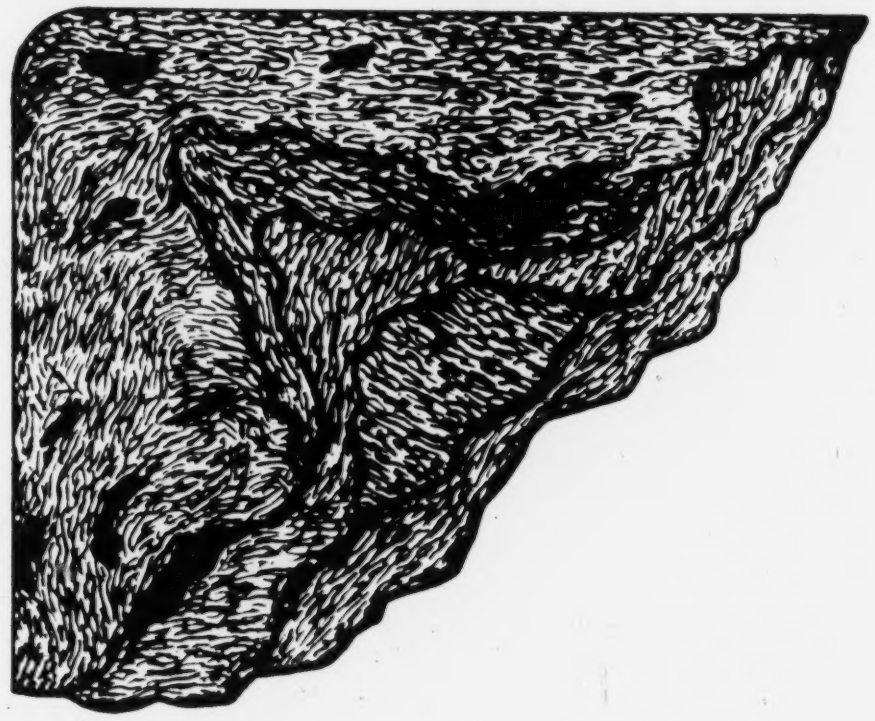


Fig. 3.



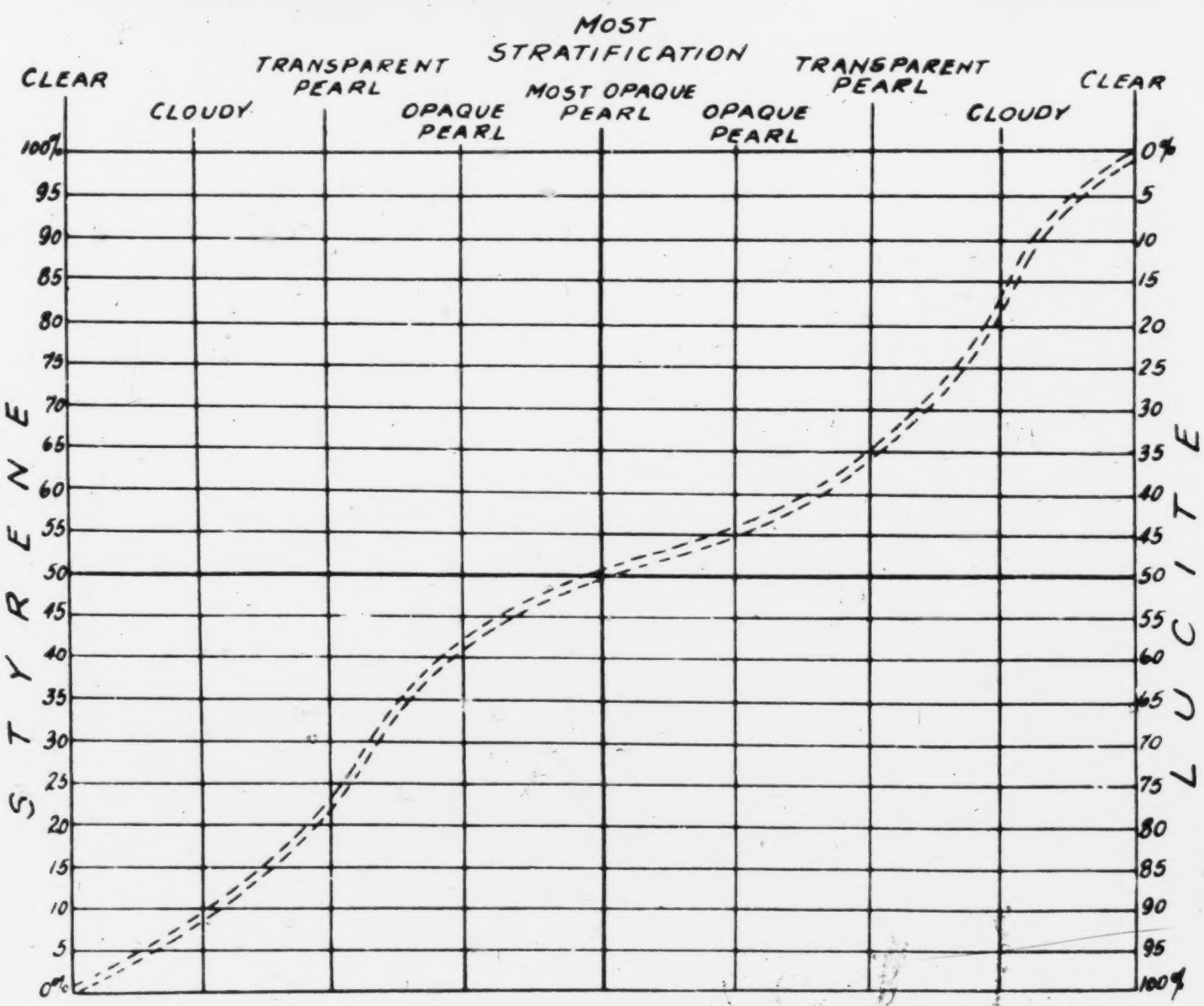


Fig. 5.

INVENTOR:
Gerald Hyseonling
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HIS ATTORNEYS.

Defendants' Exhibit 9A

Patented July 11, 1944 2,353,457

UNITED STATES PATENT OFFICE

2,353,457

SYNTHETIC PEARL RESIN

Gerald A. Goessling, Richmond Heights, Mo.

Application October 7, 1940, Serial No. 360,183
12 Claims. (Cl. 18—55)

My invention relates to resins and has for its principal object the production of a resin having an appearance quite similar to pearl, but by synthetic means and entirely without the use of the pearl powders heretofore used in resins and other plastics to produce a pearl effect. This application is a continuation in part of my application Serial No. 278,253, filed June 9, 1939.

In addition to their high cost, the pearl powders commonly used have the disadvantage of being difficult to control, so that they tend to become distributed over the entire surface and give a more or less continuous pearl sheen, that is considerably different from the true pearl appearance, with its high lights and generally variegated appearance. It is a further object of the present invention, therefore, to produce an appearance which is closer to the desired true pearl effect than has been produced by previous processes using pearl powders.

My invention or discovery consists in the production of pearl effects in resins or other plastics by mixing the molding powders of two clear plastics or one clear and one translucent plastic and subjecting the mixture to suitable heat and pressure to produce a molded article which has a distinct pearl-like appearance and luster. Specifically, the invention consists in mixing transparent Lucite and transparent styrene and subjecting the mixture to sufficient heat and pressure, preferably in an injection molding machine, to produce a pearl-like resin.

In the accompanying drawing,

Figs. 1 and 2 are views of small trays embodying my invention, the pearl effect with its variations of light and color, being inadequately illustrated, due to the limitations of a black and white drawing,

Fig. 3 is a view of a broken specimen, showing the laminated or stratified character of the structure as indicated by the splitting of the body,

Fig. 4 is a diagrammatic sectional view of a typical injection molding machine; and

Fig. 5 is a diagram showing the effect of varying the proportions of the two ingredients.

I have found that the molding powder of styrene (vinyl benzene) and the molding powder of Lucite (methyl methacrylate) mixed in substantially equal quantities constitute the best raw materials for my composition.

The powders are mixed and to them may be added any desired coloring compound so as to produce any desired color effects in the finished product.

As indicated in Fig. 4, the mixed powders are placed in a hopper 1 from which the mixture is fed into the heating cylinder 2 of any suitable injection molding machine and are heated to a temperature which is a suitable molding temperature for the two ingredients. The temperatures at which the various resins should be molded are well known and the proper temperature for the mixture is thus a matter of computation. Preferably, the two materials should have molding temperatures fairly close to each other. Then the molten mixture is forced, under suitable pressure, through a nozzle 3 into the mold 4 and left there until sufficiently chilled.

The molten materials on being forced into the mold, appear to retain their individuality and constituting a heterogeneous mixture instead of forming a new homogeneous composition. The result is that the structure is made up of a multiplicity of sheets, strips or stratified layers of the respective resins. These several layers or sheets are thoroughly interlaced and intermingled and become firmly united. The result is a laminated or stratified structure, somewhat resembling that of mica, but with the several strips or layers being of much less thickness and being much more closely intermingled and varying in size, shape and angularity of position. Some of said layers may have a rippled or wavy surface and all of the surfaces have a glassy, polished appearance when separated. Thus there results a wide variation of internal shape and structure on the part of the several layers going to make up the complete article, so that there are all sorts of light reflecting surfaces, some large, some small and arranged at many different angles. The top and bottom surfaces are made quite smooth by contact with the die surfaces. The finished product has an opaque appearance, unless held up to the light, when it becomes translucent or transparent. It has a true pearl-like character, being iridescent, having many high lights and varying in color throughout. If the clear molding powders are used without anything else, the finished product has the appearance of a white pearl. By the addition of coloring powders in the quantities desired, any sort of color effect can be obtained. Instead of being uniform throughout the piece, the color also varies after the fashion of color in pearl. Fig. 2 shows patches of distinct color resulting from the use of coloring powder.

Instead of an injection mold, an ordinary compression mold may be used. While the compression molding process produces laminations and results in a pearly effect, the compression mold tends to product layers which are all parallel

with the main surfaces, so that there are not the numerous high lights and gradations of shading and color that result from the widely varying shapes of the layers that result from the injection molding process.

The results may be varied by changing the ingredients and the proportions thereof and also by changing the particle sizes of the molding powders. As above stated, equal proportions of clear methyl methacrylate and clear styrene are preferred and result in the most pronounced pearl effect and the most nearly opaque structure. As the proportion of one ingredient is increased, the opacity of the final product decreases, so that the pearl becomes less and less opaque, then what might be called a transparent pearl, and finally when there is only a very small proportion of one ingredient, the result is merely a cloudy mixture. Fig. 6 is a diagram showing the effects obtained by varying the proportions of the styrene and methyl methacrylate. It will be understood that the several points marked as most opaque pearl, opaque pearl and so on, are not precise points, but merely approximations of the effects indicated. As the diagram shows, the pearl effect varies only slightly until one ingredient is considerably in excess of the other, after which there is a sharp drop in the pearl effect.

The thickness of the finished article is also important in selecting the proportions of ingredients. In a very thin section, say around $\frac{1}{16}$ inch, reducing one ingredient to say 5 or 10 per cent would make an article so nearly transparent as to greatly reduce the pearl effect. In a very thick section, however, say $\frac{1}{2}$ inch or more, a small percentage of one ingredient produces an excellent pearl effect.

As one ingredient is used in appreciably larger proportions, the mixture tends to take on the mechanical and physical properties of that ingredient, thus affording further evidence that my final product is a heterogeneous body comprising stratified closely united multiplicity of layers or strips of the respective ingredients and not a homogeneous single compound resulting from the mixing of the two. For instance, as styrene is used in excess of methyl methacrylate, the metallic ring characteristic of styrene becomes more and more pronounced.

The heat should be carefully controlled to produce the best results. The temperature should be selected with regard to the temperature that produces the free flowing plastic condition of the two compounds, in order to produce a statified effect with a firm bond between the several layers. If the temperature is not properly selected, being either too high or too low, the several parts may not be firmly bonded and the parts may peel away from each other. The molding temperatures for the various resins, as styrene and methyl methacrylate are well known and the proper temperature can be selected. I have found the best temperature for the styrene and methyl methacrylate mixture to be between 380° and 420° F., but lower or higher temperatures may also be used. The free flowing qualities of styrene are well known and I have found that the presence of styrene in the mixture improves the flowing qualities of the methyl methacrylate.

A similar structure, with pleasing effects, although not with a true pearl-like appearance, can be produced by using with a transparent material a material that has been made translucent by the addition of any of the well known ingredients for producing translucence. Either the translucent Lucite or translucent styrene may be used. The result of the use of the material that is only translucent is to minimize the optical effects that produce the pearl-like appearance. However, the appearance thus produced is quite attractive and, so long as some transparent material is used, there is a distinct pearl effect.

After tests of numerous resin mixtures, I have found the Lucite-styrene mixture to be the best, both as to beauty of pearl appearance and as to strength of structure, but other mixtures have been found to be fully satisfactory. One such mixture is that of vinylite (vinyl chloride) and styrene. Another such mixture is cellulose acetate butyrate and Vinylite (vinyl chloride). The pearl effect can also be produced by the mixture of three or more different resins, as Lucite, Vinylite and styrene.

The requirements are that one resin be transparent and the other or others tranparent or translucent and that the resins be sufficiently incompatible that they do not melt into a homogeneous mixture, but preserve their identity in separate strata, which strata are however adherent to each other so as to create a strong structure. All of the specific combinations hereinabove set forth fully satisfy the requirements as do mixtures of other clear resins. In all cases, it is necessary to mold the mixture to produce the desired pearl effect. The final product comprises the polymers of the several resins.

My composition is the first in which the pearl effect of high lights, iridescence and variegated shading is produced by the physical structure and mixture of the composition itself without the aid of pearl powders to produce the pearl-like sheen. The finished product has many uses: its purely decorative character is obvious and its strength is comparable with that of other resins, so that it may be used in almost any place where other resins may be used. By changing the composition and by adding different coloring materials in various amounts, all sorts of color and optical effects may be obtained.

What I claim is:

1. A composition of matter consisting essentially of a molded heterogeneous mixture of at least two clear incompatible thermoplastic resins in the form of a multiplicity of separate, but firmly bonded layers of the respective materials, said layers being of irregular size, shape and arrangement to form a multiplicity of irregularly disposed light reflecting surfaces within the body of the material whereby said composition has the appearance of pearl without the addition of pearl powders.

2. A composite resin having a pearl-like appearance without the addition of pearl powder consisting essentially of a molded mixture of the polymers of styrene and methyl methacrylate characterized by a multiplicity of separate, but firmly bonded, layers of the two materials, said layers being of irregular size, shape and arrangement to form a multiplicity of irregularly disposed light reflecting surfaces within the body of the material.

3. A composite resin consisting essentially of a molded mixture of the polymers of styrene and vinyl chloride characterized by a multiplicity of separate, but firmly bonded, layers of the two materials, said layers being of irregular size, shape and arrangement to form a multiplicity of irregularly disposed light reflecting surfaces within the body of the material whereby said composition

Defendants' Exhibit 9A

has a pearl-like appearance without the addition of pearl powder.

4. A composition of matter consisting essentially of a molded heterogeneous mixture of polymeric styrene and at least one incompatible thermoplastic resin, said composition being characterized by a multiplicity of separate, but firmly bonded, layers of the two materials, said layers being of irregular size, shape and arrangement to form a multiplicity of irregularly disposed light reflecting surfaces within the body of the material, whereby said composition has a pearl-like appearance without the addition of pearl powder.

5. The process comprising mixing clear polymeric methyl methacrylate and polystyrene molding powders without the addition of pearl powders, heating said mixture above the melting point thereof and then molding the same into a stratified body of light reflecting layers having the appearance of pearl.

6. The process comprising mixing polymeric methyl methacrylate and polystyrene molding powders without the addition of pearl powders, heating said mixture above the melting point of said powders and then subjecting the same to heat and pressure to form closely intermingled, stratified layers of irregular shape and arrangement having the appearance of pearl.

7. The process of making a plastic of substantial strength and with a variegated, pearl-like iridescent appearance, which comprises mixing polymeric methyl methacrylate and polystyrene molding powders, heating said mixture above the melting point of said powders and forcing a portion thereof under pressure into an injection mold to form closely intermingled stratified layers having the appearance of pearl.

8. A composition of matter comprising a molded heterogeneous mixture of substantially equal proportions of polystyrene and polymeric methyl methacrylate, said composition having the appearance of pearl without the addition of pearl powders.

9. The process comprising mixing polymeric methyl methacrylate and polystyrene molding powders, one clear and one translucent, without the addition of pearl powders, heating said mixture above the melting point thereof and then molding the same into a stratified body of light reflecting layers having the appearance of pearl.

10. The process of making a plastic of substantial strength and with a variegated, pearl-like iridescent appearance, which comprises mixing substantially equal quantities of polymeric methyl methacrylate and polystyrene molding powders, heating said mixture above the melting point of said powders and forcing a portion thereof under pressure into an injection mold to form closely intermingled stratified layers having the appearance of pearl.

11. The process of making a plastic of substantial strength and with a variegated, pearl-like, iridescent appearance, which comprises mixing substantially equal quantities of polymeric methyl methacrylate and polystyrene molding powders, and a suitable amount of a coloring compound, heating said mixture above the melting point of said powders and forcing a portion thereof under pressure into an injection mold to form closely intermingled stratified layers having the appearance of pearl.

12. A composition of matter in the form of a molded heterogeneous mixture consisting of substantially equal proportions of polystyrene and polymeric methyl methacrylate, said composition having the appearance of pearl.

GERALD A. GOESSLING.

Defendants' Exhibit 9A

Patented Jan. 2, 1940 **2,185,789**

UNITED STATES PATENT OFFICE

2,185,789

THREAD AND FIBER OF ORGANIC THERMOPLASTIC MATERIALS AND PROCESS OF PRODUCING THE SAME

Heinrich Jacqué, Ludwigshafen-on-the-Rhine, Germany, assignor to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany

No Drawing. Application June 26, 1937, Serial No. 150,656. In Germany June 30, 1936

5 Claims. (Cl. 18—54)

The present invention relates to threads and fibers of organic thermoplastic materials and a process of producing the same.

I have found that fibers or threads fit to be spun and possessing excellent mechanical properties can be obtained from organic thermoplastic materials by splitting up to the desired degree of fineness, thin foils, films, bands, tubes or threads of the said materials which have acquired by stretching a high degree of orientation in the longitudinal direction, in the direction of this orientation. This splitting of the unilaterally orientated foils and the like may easily be effected by grating, turning, twisting, brushing or with the reeling, combing or carding machines usual in the hemp, flax or jute industries, or by beating them with wedge- or knife-shaped hammers in the direction of the orientation upon an elastic bottom or by forcing them in the direction of orientation through fluted rollers. By such treatment, the said materials yield more or less long, extremely fine fibers or threads which are similar to natural fibers or also staple fibers. The splitting of the foils and the like is preferably effected at room temperature or at lower temperatures because at higher temperatures the marked orientation of the foils frequently reverts. Suitable highly polymerized thermoplastic masses are for example polymerized vinyl chloride, afterchlorinated polymerized vinyl chloride, polymerized styrene, polymerized vinyl esters, polymerized acrylic compounds and their homologues, polymerized vinyl carbazole, mixed polymerization products of at least two of the said compounds and cellulose derivatives. The preparation of the unilaterally orientated foils, films, bands, tubes or threads may be effected by especially strong stretching between rollers or by drawing foils, films, bands, threads or tubes over heated surfaces, preferably over heated cylinders or through short hot zones with strong stretching in the direction of tension so that they acquire a multiple of their original length. The fibers and threads thus obtained may be twisted in the same way as natural or staple fibers and then worked up into fabrics or brought into a form similar to cotton wool. By warming or steaming they can also be curled like wool. When starting from crapey foils curled fibers are obtained immediately. The fibers or threads obtained according to this invention are irregularly rhomboid or rectangular in the cross-section and possess more or less sharp edges in contrast to the threads and fibers hitherto prepared from the same thermoplastic materials. The filaments prepared from the said fibers and threads can be employed for the same purposes for which filaments of wool, cotton, silk or artificial silk are usually employed. On account of their high resistance to water, acids, alkalies and putrefaction the fibers or threads according to this invention can advantageously be used for the production of fishing nets, filtering-cloth, gaskets and tightening rings. On account of their high elasticity they are also suitable for upholstering purposes. Threads and fibers of polyvinyl chloride are uninflammable. Most of the threads and fibers of the said organic thermoplastic materials have a high electrical insulating power and can therefore advantageously be used for electrical insulating purposes. Compared with the known processes, the process according to this invention has considerable technical advantages. Thus for example no solvent is necessary; this renders the process extremely economical as regards the readiness with which it may be carried out in practice. It is also possible to prepare threads even from insoluble or difficultly soluble substances which are very sensitive to temperature, as for example polymerized vinyl chloride of very high molecular weight; this was hitherto impossible.

It is well known that foils or bands which are oriented in only one direction can be broken or split relatively easily in the direction of the orientation. Those foils possessed, however, an insufficient degree of orientation and were too thick and yielded therefore, when split in the direction of orientation, only more or less jagged splinters or even powders, but no fibers or threads as are obtained by splitting thin foils, bands and the like having a high degree of orientation according to the present invention.

There does not exist any certain limit just to all organic thermoplastic materials as to the degree of orientation and of the thickness which foils, bands and the like must possess in order to be capable for being split to threads or fibers according to this invention. The limits vary for the different thermoplastic materials. Generally speaking, the foils, bands and the like must have such a high degree of orientation and must be so thin that they are split to fibers or threads when being brushed or when being twisted.

The following examples will further illustrate how the present invention may be carried out in practice, but the invention is not restricted to these examples.

Defendants' Exhibit 9A

Example 1

A foil of afterchlorinated polymerized vinyl chloride which has been stretched to about 45 times its original length by moving a 0.04 mm. thick foil at a speed of 0.25 m. per minute to a cylinder heated to about 135° C. and drawing it over the cylinder with a speed of 11.5 m. per minute. The foil thus obtained has a thickness of about 0.001 millimetre is cut into strips about 3 millimetres in width. One or more of such strips are drawn between two rubber plates which are slid backwards and forwards by slight pressure perpendicularly to the direction of the strips. By the friction and rolling action thus taking place, the strips are split up into very many single threads which may be further split and arranged parallel to each other by a rotating cylindrical brush. The threads and fibers thus obtained yield, after spinning and twisting, threads of silky lustre and good mechanical properties and especially a very high tensile strength.

One of the rubber plates which slide backwards and forwards may also be constructed with advantage as a rotary cylinder or endless rubber band which moves forward simultaneously with the foils or bands to be split.

The foils may also be split to a ball of fibers placing them separately in their layers between two or more brushes which are moved backwards or forwards in the direction of orientation. The fibers obtained can be spun to yarns similarly to staple fibers and the yarns can be worked up to filaments.

Example 2

A polymerized styrene foil, which has acquired about 7 times its original length by stretching in one direction over a cylinder heated to about 120° C. and which has a thickness of about 0.006 millimetre is split up into single threads in the manner described in Example 1.

Example 3

A small band of afterchlorinated polyvinyl chloride similar to that described in Example 1 but having a thickness of about 0.0025 millimetre is put into a silk twisting machine, in which it gets a twist of about 1000 turnings per meter. The direction of the twist is changed thereby from 3 to 4 times. The band is split by that treatment into fine threads having a curling like wool.

By twisting the threads obtained by applying about 200 turnings per meter a fast closed thread of a silk-like lustre is obtained.

In a similar manner there can also be worked up bands of polystyrene of a high degree of orientation and about 0.05 millimetre thickness.

Example 4

A foil of polyvinyl chloride of a high degree of polymerization which is 0.015 millimetre thick and which was stretched in the thermoplastic state to a multiple of its original length, is dipped for a short time into dioxane or benzene and then treated between two rubber plates similar as described in Example 1. The foil is thus split to fibers which can be worked up to yarns and filaments in the manner usual for staple fibers.

What I claim is:

1. A process of producing threads and fibers from highly polymerized organic materials which comprises forming a thin film of the material and stretching it in the direction of its length sufficiently to produce an orientation of the molecules in the direction of length and to render the film capable of disintegration by friction into fibers, and frictionally working the film to disintegrate it into fibers.

2. A process of producing threads and fibers from highly polymerized organic materials which comprises forming a thin film of the material and stretching it in the direction of its length sufficiently to produce an orientation of the molecules in the direction of length and to render the film capable of disintegration into fibers, and twisting the film to disintegrate it into fibers.

3. A process of producing threads and fibers from highly polymerized organic materials which comprises forming a thin film of the material and stretching it in the direction of its length sufficiently to produce an orientation of the molecules in the direction of length and to render the film capable of disintegration into fibers, and brushing the film to disintegrate it into fibers.

4. A process of producing threads and fibers from highly polymerized organic materials which comprises forming a thin film of the material and stretching it in the direction of its length sufficiently to produce an orientation of the molecules in the direction of length and to render the film capable of disintegration into fibers, and rubbing the film to disintegrate it into fibers.

5. Threads and fibers of highly polymerized organic materials being from rhomboid to rectangular in the cross-section and possessing sharp edges, produced in accordance with the process defined in claim 1.

HEINRICH JACQUE.

Defendants' Exhibit 9A

Dec. 3, 1940. C. J. MALM **2,223,376**

YARN

Filed May 16, 1936

Fig. 1.

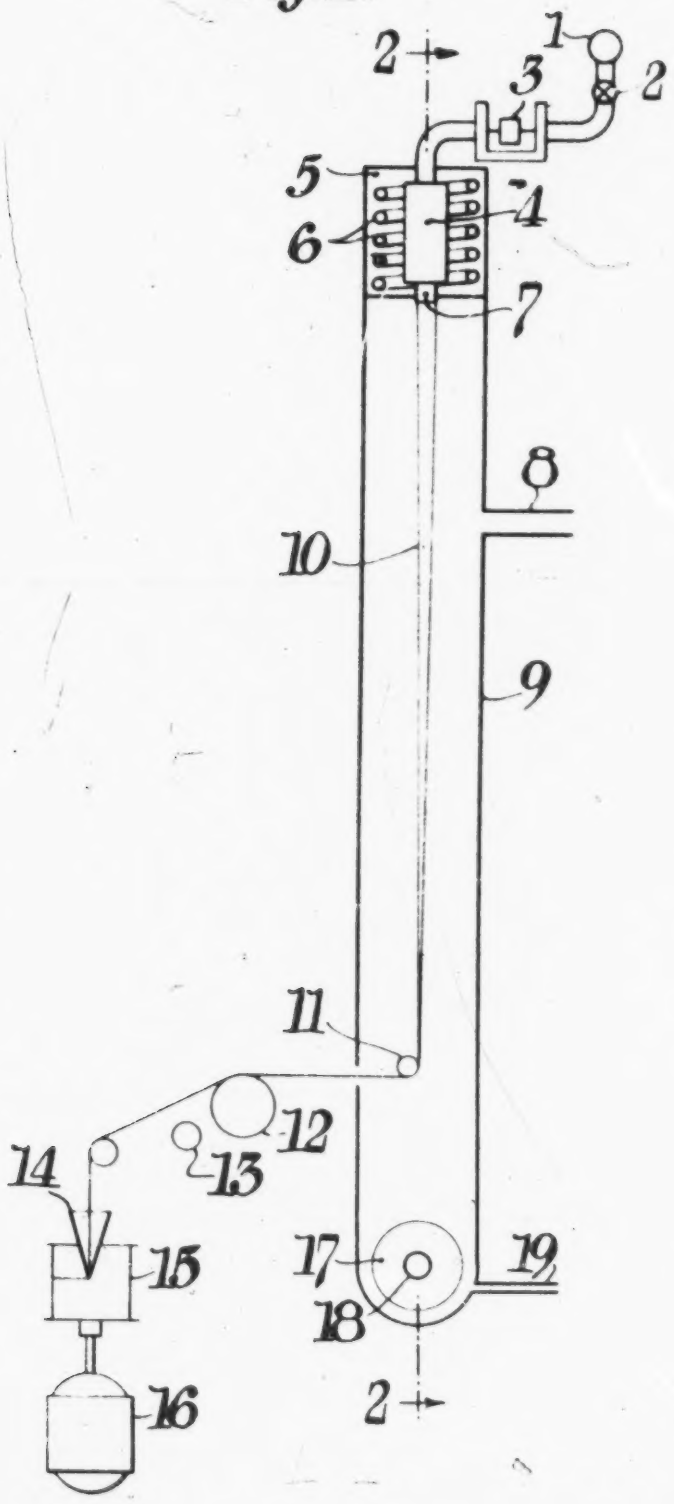


Fig. 2.

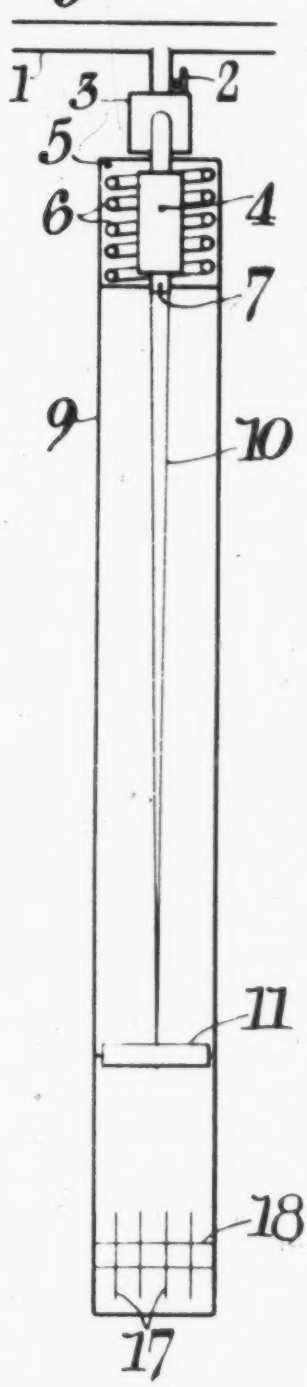
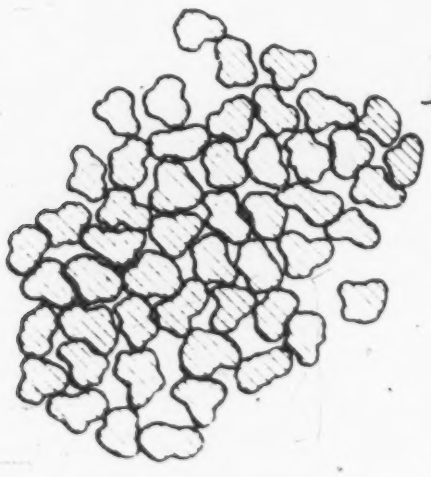


Fig. 3.



BY

Carl J. Malm,
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ATTORNEYS

Defendants' Exhibit 9A

Patented Dec. 3, 1940 **2,223,376**

UNITED STATES PATENT OFFICE

2,223,376

YARN

Carl J. Malm, Rochester, N. Y., assignor, by mesne assignments, to Eastman Kodak Company, Rochester, N. Y., a corporation of New Jersey

Application May 16, 1936, Serial No. 80,122

5 Claims. (Cl. 28—1)

The present invention relates to the preparation of yarn from a mixed organic acid ester of cellulose containing acetyl and 1-6% of propionyl or butyryl and which has a viscosity of 200-800 seconds. This application is a continuation-in-part of my application Serial No. 18,215, filed Apr. 25, 1935, now U.S. Patent No. 2,097,464.

In the preparation of yarn from cellulose acetate or related cellulose esters, it is desirable to obtain a large proportion of filaments having a cross section which is full rather than flat. It is also desirable to obtain a product having high wet and dry strengths. In the preparation of yarn from cellulose esters, it often occurs that a product giving a high tensile strength has a poor cross section and vice versa. The cross section of silk which is the strongest filament is approximately circular. In the making of artificial yarn, it is desirable that the filaments have a cross section approaching that of silk.

One object of my invention is to prepare a yarn containing a large proportion of filaments having a cross section approaching that of silk. Another object of my invention is to prepare yarn made up of filaments having a full cross section and, at the same time, a high tensile strength, both wet and dry, and which is very resistant to abrasion and deformation. A still further object of my invention is to obtain yarn which because of its high strength and resistance to abrasion and deformation permits faster processing, thus making possible increased production of textiles therefrom without any increase in the amount of apparatus employed.

I have found that by preparing yarn from a cellulose acetate containing 1-6% propionyl or butyryl which ester has a viscosity of 200-800 seconds (4:1 acetone viscosity) filaments are obtained which have a full cross section but which also have high tensile strength. I have found that it is also desirable that the esters employed be high in clarity.

Yarn from filaments having a flat cross section are more sensitive to textile processes thus requiring slower processing of the yarn obtained therefrom. This yarn also gives uneven qualities in the resulting fabrics, possible due to the twisting of the yarn causing an uneven surface thereon.

Yarn from filaments having a low tensile strength and particularly a low wet strength obviously are sensitive to processing especially where washing is involved and the amount of wear obtained with such filaments does not compare with that obtained from films with higher tensile strength. By the present invention yarn is obtained which is superior either as to cross section or tensile strength or both to yarn prepared from other types of cellulose esters.

The accompanying drawing illustrates a suitable method for preparing yarn in accordance with the present invention. Fig. 1 is a side elevation of a unit of a spinning machine which may be employed in producing artifical yarn according to my process.

Figure 2 is a section at right angles to Figure 1 taken through the line 2—2 of Figure 1.

Figure 3 is a cross section of a filament prepared in accordance with my invention.

1 represents the pipe or manifold through which the cellulose ester solution or dope may be supplied by means of valve 2 and pump 3 to the filamenting apparatus. The dope or solution passes through a candle filter 4 which is enclosed in a chamber 5 heated by means of hot water coils 6 or other well known heating means as described and claimed in Stone Patent No. 2,000,047. This chamber 5 is separated from the spinning cabinet 9 by a partition which may be well insulated if desired. In fact it is preferred to insulate the entire chamber 5.

If the temperature at which it is desired to keep the candle filter should be considered unimportant, obviously the hot water coils may be omitted and if some heat is desired around the candle filter, the heated air from below may be allowed to surround it. It is, however, desirable as described in the above Stone patent to maintain the candle filter at a temperature somewhat above that of the air of the spinning chamber. The candle filter 4 is connected with a spinnerette 7 to form the dope as it comes through the candle filter into filaments of a desired size and deliver them into the heated air present in the spinning cabinet 9. The cabinet 9 is provided with an air inlet 19 at its lower end in which is located a steam pipe 18 with heat dissipating fins 17, which heats the incoming air. Obviously other means of heating the incoming air than that shown may be employed. The steam pipe with heat dissipating means located in the bottom of the cabinet is shown merely as an example of one means which may be employed to heat the incoming air. The solvent laden air in the upper portion of the cabinet may be removed through the outlet 8 which leads to a solvent recovery apparatus, the outlet 8 being preferably located a little below the top of the spinning cabinet.

After the dope is forced through the spin-

nerette 7, into the heated air, the solvent evaporates from the formed filaments, forming threads. The thread passes over the guide roll 11 (or if desired a fixed guide may be employed) and out of a small aperture in the cabinet to the draw roll 12 from whence it is conducted to the spinning pot or bobbin 15, through the guide 14, to assure uniform winding of the thread. The spinning pot or bobbin is rotated by means of a motor, a tape or a belt drive or any other suitable device which may also be employed for operating the guide 14 in any suitable manner desired. A waste roll 13 is provided below the draw roll 12 to collect any threads which might drop from the draw roll.

It is to be understood that instead of a spinning pot and roll winding, any other method such as cap spinning, may be employed to collect the thread after its formation.

The dope which may be employed in preparing yarn in accordance with my invention may be prepared by dissolving the cellulose ester in acetone to form approximately a 20-25% solution of the ester. A small amount of non-solvent may be embodied in the dope, for instance the solvent may consist of approximately 97% acetone and 3% water. If some other non-solvent is desired, such as methyl alcohol, the solvent used may consist of 85% acetone and 15% methyl alcohol. If it is desired to use ethyl alcohol, a suitable solvent mixture would be one containing 90% acetone and 10% of ethyl alcohol. These proportions are merely illustrative of the concentration of non-solvent in the solvent mixture and may be varied over quite a wide range. Obviously, other well known solvents may be employed instead of acetone.

It is desirable that the cellulose ester used in the preparation of yarn in accordance with my invention have a turbidity in its esterification mixture of not more than 35 parts per million. This turbidity is determined by comparison with a turbidity solution which has been standardized by the U.S. Bureau of Standards. The preparation of esters which are suitable for use in the present invention is described in my co-pending application Serial No. 18,215, filed April 25, 1935 now U.S. Patent No. 2,097,464 of which this is a continuation-in-part. I have found that the tensile strength of filaments formed by the dry spinning method is affected by haze or lack of clarity of the cellulose ester when dissolved in the spinning solvent. Therefore, the use of esters of high clarity and of the indicated viscosity is desirable to obtain optimum strengths. Figure 3 of the drawing represents examples of cross sections of the filaments of the yarn prepared in accordance with the present invention. It will be noted that filaments having a full cross section are present in large proportion in the yarn.

The viscosity of the cellulose esters to be employed in my invention is determined by dissolving one part of the ester in four parts of acetone and determining the time in seconds necessary for a 5/16 inch steel ball to drop through 10 inches of the solution in a tube 1 inch in diameter at a temperature of 20° C.

The following example illustrates the preparation of yarn from a cellulose acetate containing 1-6% propionyl and having a viscosity of 200-800 seconds in accordance with my invention. Cellulose acetate containing about 1½% propionyl and which has been hydrolyzed to acetone solubility (about 38% apparent acetyl) was dissolved in acetone containing 2½% of water to form a 25% solution of the ester. The solution was then introduced into a spinning system of the type illustrated by Figures 1 and 2 by means of the valve 2 and pump 3. The dope was passed through the candle filter 4 and the spinnerette 7, the candle filter being kept constantly at a temperature of 65° C. The temperature at the bottom of the cabinet was maintained at 58° C. by incoming heated air. The withdrawal temperature of the solvent-laden air was found to be 48-53° C. Air was passed trough the cabinet at the rate of 20 cu. ft. per minute, and a thread of approximately 150 denier was formed. If a spinnerette for forming larger threads is employed, it is advantageous to pass air through the cabinet at a more rapid rate.

The following table illustrates the superiority both as to wet and dry strengths of the yarn of the present invention over that of good quality cellulose acetate yarn. This also shows that the stretch of the product is about the same. The figures given below were obtained with filaments containing 1-6% propionyl.

	Dry		Wet	
	G/D	Stretch	G/D	Stretch
Good quality cellulose acetate yarn	1.38	25	.86	35
Yarn of the present invention	1.72	23	1.16	32
Do	1.65	24	1.14	34
Do	1.71	24	1.16	34

G/D indicates the tensile strength, being the number of grams per denier which is necessary to cause breaking of the yarn. The stretch is expressed as the percentage of increase in length before the breaking occurs.

Esters containing 1-6% butyryl also exhibit the desirable properties pointed out above when an ester of 200-800 seconds is employed. For instance, a cellulose acetate containing approximately 1.6% butyryl and having a viscosity of 390 seconds was dissolved, as indicated below and the yarn resulting therefrom gave the following results:

Percent cellulose ester	Percent acetone	Percent water	Percent methyl alcohol	Dry		Wet	
				G/D	Stretch	G/D	Stretch
23.6	58.0	.73	17.72	1.48	22.9	1.02	30.4
23.5	70.8	.73	4.92	1.52	23.1	1.06	31.8

I claim:

1. Yarn made of filaments of full cross section and high wet and dry strengths essentially consisting of a hydrolyzed acetone-soluble cellulose acetate containing 1-6% of saturated fatty acid groups of 3-4 carbon atoms and having a viscosity of 200-800 seconds in 4:1 acetone solution.

2. Yarn made of filaments of full cross section and high wet and dry strengths essentially consisting of a hydrolyzed acetone-soluble cellulose acetate containing 1-6% propionyl and having a viscosity of 200-800 seconds in 4:1 acetone solution.

3. Yarn made of filaments of full cross section and high wet and dry strengths essentially consisting of a hydrolyzed acetone-soluble cellulose acetate containing approximately 1.5% of saturated fatty acid groups of 3-4 carbon atoms and having a viscosity of 200-800 seconds in 4:1 acetone solution.

4. Yarn made of filaments of full cross section

and high wet and dry strengths essentially consisting of a hydrolyzed acetone-soluble cellulose acetate containing 1-6% of saturated fatty acid groups of 3-4 carbon atoms and having a viscosity of 400-600 seconds in 4:1 acetone solution.

5. Yarn made of filaments of full cross section and high wet and dry strengths essentially consisting of a hydrolyzed acetone-soluble cellulose acetate containing 1-6% butyryl and having a viscosity of 200-800 seconds in 4:1 acetone solution.

CARL J. MALM.

Defendants' Exhibit 9A

Patented Aug. 11, 1936 **2,050,286**

UNITED STATES PATENT OFFICE

2,050,286

METHOD OF MAKING SYNTHETIC STRAW

Camille Dreyfus, New York, N. Y., and William Whitehead, Cumberland, Md., assignors to Celanese Corporation of America, a corporation of Delaware

No Drawing. Application April 27, 1931, Serial No. 533,360

10 Claims. (Cl. 18—54)

This invention relates to the manufacture of synthetic straw and the like made of or containing organic derivatives of cellulose and is directed more specifically to the production of straw-like material that is more versatile in its use than straws heretofore produced.

An object of our invention is to produce artificial or synthetic straw having a more or less permanent twist imparted thereto. A further object of our invention is to produce artificial straw comprising a plurality of ends of finer straw-like material. Other objects of this invention will appear from the following detailed description.

In our co-pending U.S. application Serial No. 361,832 filed May 9, 1928, of which this is a continuation in part, we have described the process of producing artificial straw by treating yarns of organic derivatives of cellulose with a solvent and then causing the same to coalesce by applying heat and pressure thereto.

We have now found that the synthetic straw, produced in accordance with said application or in any other manner, may be treated so as to obtain a product that has many uses to which ordinary flat straw is not applicable. Thus by twisting such straw, preferably while it contains a small amount of residual solvent, a twisted straw may be obtained which has a relatively permanent twist. Moreover by twisting such straw at a high rate, or by subjecting the same to sudden and sever bending, the straw may be split into a plurality of fine straws having a denier corresponding to that of the yarns originally employed in coalescing, which individual fine straws may or may not be twisted together.

In one aspect of our invention we impart a more or less permanent twist to synthetic straw made in any manner and containing organic derivatives of cellulose so as to render it more suitable for various uses. In another aspect of our invention, we sharply twist or bend artificial or synthetic straw which has been made by coalescing and flattening a plurality of ends of yarns each consisting of a pluarilty of individual filaments, by application of a solvent and heat and pressure, so that there is produced a number of finer straws associated together with or without twist.

The straw that is twisted and/or sharply bent so as to be twisted and/or split into a plurality of finer filaments may be made in any suitable manner, although we prefer to treat the straw made generally in accordance with the method described in our U. S. application Serial No. 361,832 filed May 9, 1928.

The material to be coalesced and containing the thermoplastic derivative of cellulose may be in the form of fine filaments, of say 2 to 25 denier, which filaments may be twisted in the form of a yarn or which may be untwisted. These filaments may be in the form of artificial bristles of say 50 to 1000 denier or more or they may be in the form of artificial straw.

The thermoplastic derivative of cellulose employed in the material to be treated in accordance with our invention is preferably an organic derivative of cellulose, examples of which are organic esters of cellulose and cellulose ethers. Examples of organic esters of cellulose are cellulose acetate, cellulose formate, cellulose propionate and cellulose butyrate, while examples of cellulose ethers are ethyl cellulose, methyl cellulose and benzyl cellulose.

If particular ornamental effects are desired, such as are produced by differential color effects or by differential lustre, yarns of non-thermoplastic material may be associated with the thermoplastic material prior to coalescing to form the artificial straw. Examples of such yarns are those made of natural silk, cotton, reconstituted cellulose, wool, etc. Often the presence of these non-thermoplastic materials improves the physical strength and knotting properties of the final straw produced. If metallized effects are desired, fine flat metal bands, such as are used in making tinsel, or metallized threads or yarns may be associated with the filaments of the thermoplastic material prior to coalescing. If desired a bronze or aluminum powder or other effect materials may be incorporated in the product at any suitable stage of manufacture to produce metallic or other effects.

The filaments or yarns or other materials to be coalesced may be drawn from bobbins or other suitable packages to be treated by our process, or they may be drawn directly from the spinning machine where they are produced.

The coalescing liquid applied to the associated yarns, filaments and the like containing an organic derivative of cellulose prior to subjecting the same to heat and pressure contains a substance which is either a solvent or a restricted solvent for the organic derivative of cellulose. Examples of such solvents or solvent mixtures are acetone, ethylene dichloride and ethyl or methyl alcohol, dischlorethylene and ethyl or methyl alcohol, etc. Often it is advantageous to add high boiling solvents or plasticizers such as triacetin, diacetin, dibutyl tartrate, tricresyl phosphate to the coalescing fluid. If desired, this sol-

Defendants' Exhibit 9A

vent liquid may have dissolved therein a suitable desired proportion of an organic derivative of cellulose, and this organic derivative of cellulose may be any of those above mentioned. The solvent liquid may be applied in any suitable manner thus by means of wicks, rolls, rods, by spraying the same onto the yarns or filaments, or by immersing the same in the liquid in their passage to the heat and pressure device. If the straw is to be split into finer straws, a relatively smaller amount of solvent or restricted solvent is applied.

Any suitable means may be employed for applying heat and pressure to the yarns or filaments of organic derivatives of cellulose after the solvent liquid has been applied thereto. This pressure device may assume the form of a pair of rollers rotating at opposite directions at the same peripheral speed. At least one of the rollers is heated to a suitable temperature by any suitable means such as steam, hot water, electrical resistances, etc. These rollers may have plain and smooth surfaces, or they may have interrupted surfaces. Thus they may be engraved, fluted or have other surfaces to crinkle, emboss or produce similar fancy effects upon the finished artificial straw. One of the rolls may be constructed and operated as a printing roll and be caused to apply a suitable printing paste to the artifical straws under formation, and thus produce a printed design on the product.

As to temperature and pressure to be employed in coalescing, the application of high pressures and/or high temperatures produces a clear continuous product and these are preferably used when the straw is to be merely tinted without being split. Lower temperatures and/or pressures may be employed to obtain products where the outline of the original filaments, yarns and the like are still perceptible, and these are preferably employed when the straw is to be split.

The amount of solvent applied will vary with the heat applied and also the size of the yarn and the size of the filaments in the yarn. Generally, the finer yarns and finer filaments require less solvent to effect coalescence.

Another mode of producing the straw to be treated in accordance with this invention is to moisten the yarns with a coalescing solvent and then draw the same under slight tension through a tortuous path between two or more knife-edge members, which have the effect of spreading out the wetted band into a flat straw.

The synthetic straw may be twisted in accordance with this invention by any suitable method, such as by means of ring, flier, cap spinning bobbins or the like. If this twisting is done at a relatively low rate, and particularly when the synthetic straw contains a small amount of residual solvent, a more or less permanent twist is imparted thereto, and the original straw may or may not be split up into finer straws. However by twisting such straw, particularly when made by coalescing of a plurality of ends of yarn, at comparatively high rates, such as with twisting spindles rotating at 5000 R. P. M., the straw is twisted and at the same time split into finer straws, the individual size of which is approximately equal in denier to that of the individual ends of yarn used in the coalescing process.

However it is not necessary that the straws be twisted to obtain the splitting effect. Any process involving sudden and severe bending or twisting backwards and forwards of the straw effects the splitting of the straw into finer straws. Thus the straw may be passed through a fine slot and then immediately through another slot at right angles to the first slot, thus causing the straw to twist suddenly at right angles. This effects the splitting of the straw into finer straws.

We have found it advantageous to effect the twisting or other splitting process while the straw contains a small amount of residual solvent from the coalescing process or other process used for making the same, since when traces of the solvent are present, not only does cleaner splitting of the straw occur, but where twisting is involved, the loss of solvent during twisting process or after the process sets the new form of straw in its twist. However the twisting or processing of the yarn while it contains no residual solvent is within the scope of this invention.

If desired, the twisting or other splitting process may be done continuously with the coalescing process, although it is preferable to dry the straw so as to drive off the residual solvent substantially before twisting or subjecting to severe bending. This drying may be effected by passing the straw after it leaves the coalescing rollers through a long drying path of say 8 meters at a speed of say 40 meters per minute or passing the straw in contact with drying cans or drums rotating at substantially the same peripheral speed as the coalescing rolls.

It will be understood that when the coalescing process is employed, the individual filaments forming the yarn coalesce together to form flat bands, and that these individual bands or strips formed by the coalescence of the filaments of the yarn generally do not split during the process.

Where color effects on the films or artificial straws are desired, suitable dyestuffs may be applied at any suitable stage of the process of manufacture; that is, prior to the application of the solvent liquid, simultaneously therewith or after the same has coalesced to form the finished product. Where the dyestuff is applied prior or subsequent to application of the coalescing solvent, it is preferably in the form of a solution of the dyestuff in organic solvents, as described in the application of W. Whitehead, Serial No. 284,673, filed April 4, 1928. When the dyestuff is applied prior to the application of the coalescing liquid, the same may be applied by means of wicks, rolls and the like in a continuous manner to produce uniform color, or intermittently to form differential color effects. The dyestuff may be applied if desired on one or more of the pressure rolls. A convenient mode of application of the dye is in solution in the coalescing solvent. Other modes of applying the dyestuff may be used. Thus the finished straw may be dyed in hanks or in the form of other packages by any suitable known dyeing methods.

Artificial straw or film that has a suitable lustre, or which is opaque, may be produced in accordance with our invention, and this delustered or opaque effect may be obtained as a continuous effect or only intermittently as desired. This delustered or opaque effect may be produced by subjecting the film or artificial straw to the action of water or other aqueous media, alcohol, steam or other delustering agency, after it has been formed by coalescence under the action of the solvent under heat and pressure. If a liquid is employed as the coalescing agent which consists of a mixture of a solvent for the organic derivatives of cellulose and a less volatile nonsolvent for the same in suitable proportions, upon evaporation of the solvent for the organic derivative of

Defendants' Exhibit 9A

[Attached to copy of Patent No. 2,050,286]

CERTIFICATE OF CORRECTION.

Patent No. 2,050,286. August 11, 1936.

CAMILLE DREYFUS, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, second column, line 51, for "dischlorethylene" read dichlorethylene; page 3, second column, line 30, claim 6, after "comprises" insert subjecting; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 29th day of September, A. D. 1936.

Henry Van Arsdale
Acting Commissioner of Patents.

(Seal)

cellulose, the residual nonsolvent liquid causes delustering of the resulting straw. Another mode of obtaining this effect is to apply a soluble metal salt (such as that of barium, strontium or calcium) to the yarns or filaments about to be coalesced, either by the coalescing liquid or by separate application, and then subsequent to the coalescing step subjecting the straw or film thus produced to a chemical treating bath that precipitates the metal in the form of an insoluble compound (such as sulphate, carbonate or phosphate).

If high lustre and water proof properties are desired in the final straw, such straw after coalescence or during coalescence may be pressed between smooth rollers having waxes like carnauba wax or beeswax thereon.

In order further to illustrate our invention but without being limited thereto, the following specific example is given.

Example

A number of ends of yarn, say 15, made of cellulose acetate that is soluble in acetone, and each yarn having a denier of 300 and containing 80 filaments, is employed. These individual ends of yarn may have a twist of say 2½ turns per inch. These yarns may be wound from bobbins or may be drawn directly from the spinning machine from which they are formed, or some of the yarn may be drawn from bobbins and others from spinning machines. These yarns are passed in contact with a slowly rotating flannel roll which dips in a bath of acetone to a pair of coalescing rolls heated at 75° C. and rotating with a peripheral speed of 40 meters per minute. The flannel roll is caused to rotate at such speed that the amount of acetone applied to the yarn is equal to 35% of the weight thereof. The top roll is caused to press on the straw being formed with a pressure of 10 pounds per square inch.

The straws so formed which may have a width of say 0.25" and a thickness of say 0.006" are then wound up on a bobbin. While the straw still contains not less than 0.1% residual solvent, the bobbin of straw so formed is placed on vertical spindles rotating at 8000 R. P. M., the straw is drawn over the head of the bobbin through a guide situated conveniently at a short distance above the centre of the bobbin, and from thence to a winding up bobbin driven in a conventional manner. The winding up bobbin is caused to rotate at a suitable speed, say 25 M. P. M., according to the amount of twist required. The product obtained by this processing consists of a twisted association of 15 ends of fine straw of 300 denier each, each having a width of 1/60 of an inch and a thickness of 0.006".

It is to be understood that the foregoing detailed description is given merely by way of illustration and that many variations may be made therein without departing from the spirit of our invention.

Having described our invention, what we desire to secure by Letters Patent is:

1. Method of treating synthetic straw and the like produced by coalescing a plurality of yarns or filaments, which comprises subjecting the straw or the like to severe bending so that the material is split lengthwise and forms a plurality of finer straws.

2. Method of treating synthetic straw and the like produced by coalescing a plurality of yarns or filaments containing cellulose acetate, which comprises subjecting the straw or the like to severe bending so that the material is split lengthwise and forms a plurality of finer straws.

3. Method of treating synthetic straw and the like produced by coalescing a plurality of yarns or filaments, which comprises bending the straw or the like in such a manner as to split the same to form a plurality of finer straws and to leave said finer straws substantially free from twist.

4. Method of treating synthetic straw and the like produced by coalescing a plurality of yarns or filaments containing cellulose acetate, which comprises bending the straw or the like in such a manner as to split the same to form a plurality of finer straws and to leave said finer straws substantially free from twist.

5. Method of preparing an association of fine straw-like products, which comprises subjecting a synthetic straw produced by coalescing a plurality of yarns or filaments containing an organic derivative of cellulose to an operation involving a sharp and severe change of direction of one portion thereof with respect to an adjacent portion, whereby the synthetic straw is split into finer straw-like products.

6. Method of preparing an association of fine straw-like products, which comprises a synthetic straw produced by coalescing a plurality of yarns or filaments containing cellulose acetate to an operation involving a sharp and severe change of direction of one portion thereof with respect to an adjacent portion, whereby the synthetic straw is split into finer straw-like products.

7. Method of preparing an association of fine straw-like products, which comprises subjecting a synthetic straw produced by coalescing a plurality of yarns or filaments containing cellulose acetate while it contains a small amount of solvent to an operation involving a sharp and severe change of direction of one portion thereof with respect to an adjacent portion, whereby the synthetic straw is split into finer straw-like products.

8. Method of preparing an association of fine straw-like products, comprising coalescing a plurality of yarns containing an organic derivative of cellulose by heat and pressure in the presence of a solvent to form a straw-like product, and then splitting the resulting product into a plurality of finer straw-like material.

9. Method of preparing an association of fine straw-like products, comprising coalescing a plurality of yarns containing cellulose acetate by heat and pressure in the presence of a solvent to form a straw-like product, and then splitting the resulting product into a plurality of finer straw-like material.

10. Method of preparing an association of fine straw-like products, comprising coalescing a plurality of yarns containing cellulose acetate by heat and pressure in the presence of a solvent to form a straw-like product and then subjecting the resulting product to a twisting operation while it contains residual solvent and then subjecting the resulting product to a severe twisting operation whereby the same splits into a plurality of finer straw-like materials which are twisted together.

CAMILLE DREYFUS.
WILLIAM WHITEHEAD.

Defendants' Exhibit 9A

Plastics Technology

Stretch Orientation of Polystyrene and Its Interesting Results[1]

James Bailey[2]

ORIENTATION, as the term is used herein, means that the molecules have been displaced from a completely random distribution into some more orderly arrangement. As a consequence, the oriented material exhibits anisotropic properties. Early experiments showed that average bulk properties remained relatively unchanged, but that unidirectional properties, particularly tensile strength and optical birefringence, were profoundly modified; while some other properties experienced insignificant changes. The results of these experiments are given in Table 1.

TABLE 1. EFFECT OF ORIENTATION ON PROPERTIES

Properties Substantially Unchanged:
- (1) Coefficient of volume expansion.
- (2) Transition temperature as measured by the volume expansion method.[3]
- (3) Velocity of sound in the ultrasonic region.
- (4) Specific gravity.

Properties Changed:
- (1) Tensile strength increased 100-200% in direction of stretch in large pieces; up to 500% in small fibers.
- (2) Ultimate elongation during testing increased from 2-15% in medium-size pieces, 25-60% in small specimens, and up to 85% in very small fibers.
- (3) Crazing strength increased 300-400%.
- (4) Tensile strength reduced to one-third the original strength at right angles to the stretch direction.
- (5) Birefringence values up to 1,000 orders per inch easily obtained.
- (6) Stretching both longitudinally and laterally, as in Polyflex,[4] so as to increase the area by 800% reduced brittleness and increased toughness in polystyrene sheets to such an extent that their properties resembled those of sheet shocks made from the naturally tougher resins.

Many factors are involved in the careful determination of strength, such as temperature, rate of stressing, and shape of test piece. Polystyrene is also a very notch-sensitive material; therefore care must be taken to prevent accidental injury to the surfaces of the test pieces. In addition, the degree of orientation is not necessarily a sole function of the amount of hot stretching since relaxation may also be simultaneously taking place.

For these reasons it would be helpful if some independent means of measuring the amount of orientation produced in the test piece were available, and if some means of following the internal changes in the specimen during testing could be found. Fortunately optical birefringence, using polarized light and a Babinet compensator, provides such a tool. The setup and use of this instrument is essentially the same as that used in the determination of stress by the photoelastic method, but its interpretation is not strictly analagous in the case of hot orientation. However it does provide a useful means of comparing the orientation in different specimens before or during testing. Since the Babinet compensator measures only the difference in optical properties in the two directions at right angles to the light path, its reading is proportional to the orientation only when there is no lateral stretch, and its reading is zero when the lateral stretch equals the longitudinal stretch, as is very nearly the case in Plax Polyflex sheet.

Orientation by Stretching in One Direction

The simplest form of orientation is produced by stretching a shape of uniform cross-section in the temperature range where the material is rubbery. This range starts at the transition point (182° F.) and extends to about 350° F. Since the commercial grades of polystyrene vary in hardness, the temperature at which the optimum physical properties will be developed also varies. In general, the range from 205-250° F. will be found best where stretching can be done under slow rates and controlled conditions.

If the rate of stretching is high, the range near 350° F. must be used, and the specimen must be cooled under tension to prevent relaxation. For example, fibers of a few mils diameter may be stretched down from a ⅛-inch diameter orifice with the plastic at 450° F. if a drawing speed of 300 feet a minute or more is used, because the stress increases very rapidly as the diameter reduces, and the small diameter is maintained under high stress during its rapid cooling.

If the relation between stretch orientation, birefringence, and physical properties is to be studied, the test piece must, of course, be completely relaxed and strain-free at the beginning of the stretching in order to establish the zero position.

Figure 1 shows the results of a long series of experiments on sheet stock extruded from Catalin polystyrene molding powder. The sheets varied in thickness over the range of 0.010-0.020-inch. The specimens were punched out by a special die which gave a straight central portion ¼-inch wide and 2¼ inches long, with enlarged clamping sections at the ends. These specimens were heated to 250° F. for several minutes to relieve all strains, then cooled or reheated to the desired temperature, and stretched at constant rate in an air oven. The stretching was done by an apparatus which speeded up the pulling as the length of the specimen increased, so that a uniform rate of stretching in inches per inch was maintained until the desired amount of stretching was obtained. The specimen was then cooled rapidly to room temperature.

Stretching was done at three different temperatures: 100° C. (212°F.), 110° C. (230° F.), and 150° C. (302° F.). The birefringence was measured on each specimen and reduced to orders per inch (each order is approximately 565 millimicrons for white light).

The specimens were stressed by dead loading, using a bucket gradually filled by a low-velocity stream of water. This method gave a controlled rate of loading and permitted accurate determination of the stress at any time. The breaking strength was computed from the weight of the bucket plus water at the time of break and the original sectional area of the test piece. The rate of stressing was approximately 380 p.s.i. a minute, and the breaking time 20-30 minutes.

All of these data are plotted in Figure 1, and the following results should be noted:

(1) The annealed or relaxed strength is about 5,000 p.s.i.

(2) The crazing strength of completely unoriented polystyrene is less than 2,000 p.s.i.

(3) No crazing developed up to the breaking strength when the hot stretch was 230% and the birefringence was 540 orders an inch or more.

(4) Very little increase in strength was produced by hot stretching over 300%.

(5) The curves indicate that the maximum possible strength would be around 12,000 p.s.i.

Figure 2 gives the relation between ultimate tensile strength, hot stretching, and birefringence. These test pieces were prepared by stretching sheets extruded from Dow's 665-K27 polystyrene in an atmosphere of steam. The sheets were 18-24 inches long, 6-8 inches wide, and 0.040-inch thick before stretching.

After stretching, the sheets were cooled and inspected in a polariscope for uniformity, and specimens were punched out, one lot lengthwise to the direction of stretching, and the other lot crosswise to the direction of stretching. The birefringence was then measured. Specimens were tested in a Baldwin-Southwark machine using a stressing rate of approximately 6,000 p.s.i. a minute. This series, therefore, represents what might be called a rapid test. Higher strengths than those shown in Figure 1 would be expected, but very little increase was actually found.

The notable result of this series is that it shows that the strength is increased in the direction of orientation, but is decreased in the direction at right angles to it. The completely relaxed strength was 5,400 p.s.i., which was increased to about 11,000 p.s.i., when tested in line with orientation, and reduced to about 1,500, when tested crosswise, giving a ratio increase of 2:1 lengthwise and a reduction of 1:¼ crosswise. Part of this unexpectedly large reduction of strength crosswise is the result of the material's excessive brittleness and notch-sensitiveness which made it very difficult to obtain flaw-free samples.

It can be noted that the birefringence did not correspond to the tensile strength very closely, but is in reasonably close ratio to the hot stretching. We attribute this fact to some kind of relaxation which takes place and affects the strength, but does not affect the optical properties correspondingly.

Figure 3 shows another set of data comparable to Figure 2, except that stretching was done on a production machine equipped with two sets of pinch rolls running at different speeds; the sheet between was heated in an oven at 205° F. and stretched continuously. Under these conditions it was not possible to obtain completely relaxed sheets to determine the exact ratio of stretching, hence strengths are plotted against birefringence. The polystyrene powder used was Monsanto's L2020P11.

The shape of the curve is comparable to Figure 2 in most respects. About 12,000 p.s.i. seems to be the commercial top longitudinal strength produced by stretching under these conditions, with a crosswise strength near 2,000 p.s.i.

Strength of Small Fibers

A series of monofilaments was made by drawing down the slowly extruded rod

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[1] Presented before national conference, Society of Plastics Engineers, Inc., Detroit, Mich. Jan. 21, 1948.

[2] Vice president and research director, Plax Corp., Hartford, Conn.

[3] F. E. Wiley, *Ind. Eng. Chem.*, 34, 1052 (1942).

[4] Plax Corp. trade mark for oriented polystyrene sheets.

Defendants' Exhibit 9A

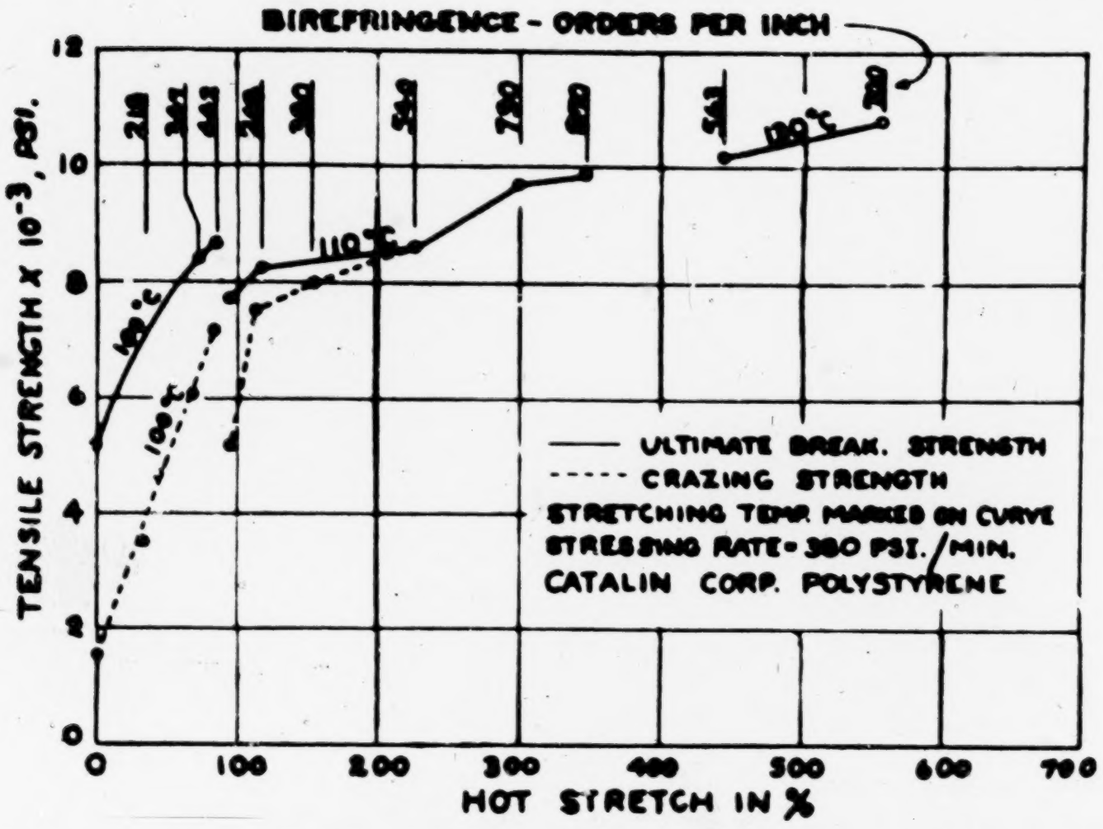

Fig. 1. Relation between Strength, Hot Stretch, and Birefringence in Catalin Polystyrene

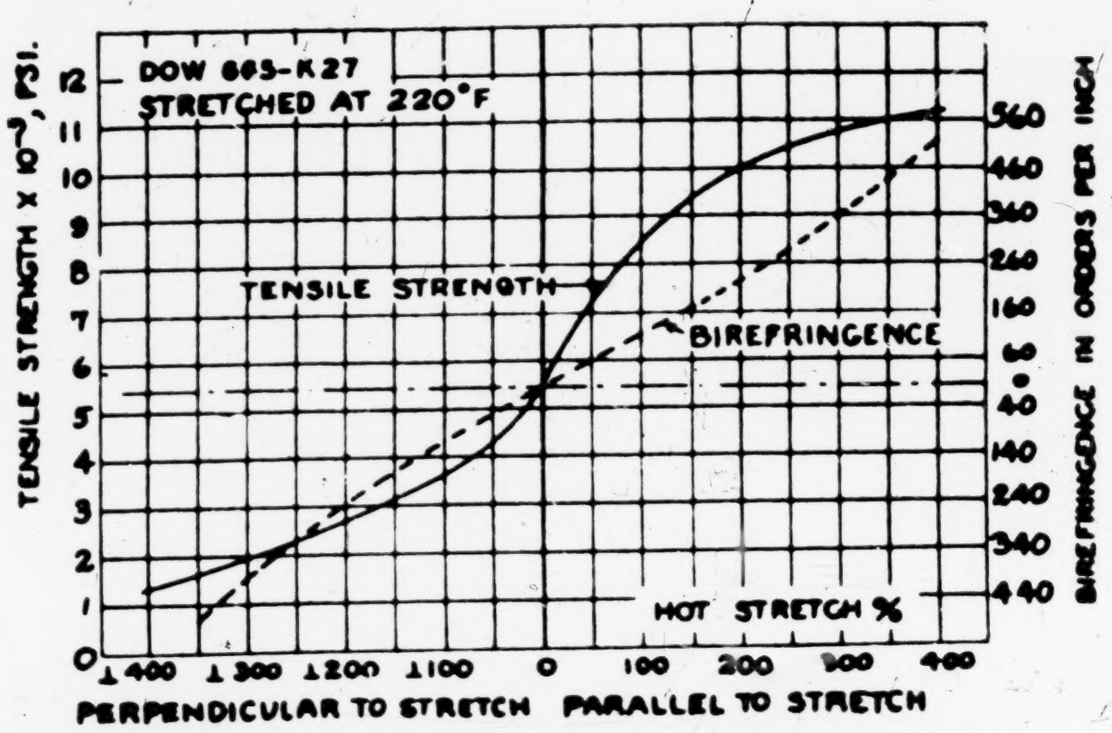

Fig. 2. Relation between Strength, Hot Stretch at 220° F., and Birefringence in Dow Polystyrene

from a 3/16-inch diameter die, heated to approximately 450° F. The rate of extrusion and drawing were controlled so that the shape of the plastic was a cone, the base of which completely filled the die. The take-away speed was between 200 and 400 feet a minute, and the winding drum was about five feet from the die. Care was taken not to injure the fibers, and they were rested for a period of about two days before testing.

Figure 4 gives the results of tests of fibers made from Dow's Q412 polystyrene. It will be noted that under the conditions of manufacture, the fibers had the approximate relaxed strength of 5,400 p.s.i. when the diameter was 0.015-inch. At a diameter of about 0.010-inch the fibers had the 11,000 p.s.i. strength of the carefully prepared and highly oriented specimens in the Figure 2 series which were cut from sheet stock. When the diameter was about 0.0025-inch, the strength had reached 35,000 p.s.i., and the curve indicates that considerably higher strengths could be obtained in the less than 0.001-inch diameter range.

Nearly all plastics, glass, and metals show this increase in strength as the diameter gets very small. It seems to be a universal law of nature and is probably a result of orientation which in these small sizes and exceedingly long stretches eliminates most of the weaknesses and permits the molecules or molecular aggregates to orient themselves into a better stress-carrying position.

Some of the fibers showed cold stretching up to 40%, while others stretched very little. It was found that heat treatment at 200° F., accompanied by a longitudinal contraction of about 10%, gave fibers showing cold elongations up to 85%. The ultimate strength of these fibers was reduced considerably by this treatment. Cold stretchings of 20-40% were generally in the range of 0.005-inch diameter and smaller fibers.

Cold stretching started by a necking down of the specimen, thus forming a rather sharp shoulder. This shoulder then progressed along the specimen until it reached some defect, and rupture occurred. In its manner of formation and behavior the necking down was very similar to that of polyethylene although, of course, very much less apparent.

Orientation by Stretching Both Longitudinally and Laterally

Bilateral orientation occurs in some forms of extrusion, including all cases where tubing is blown up larger than the die and taken away faster than the extrusion speed and in such operations as making Polyflex sheet. The German method causes bilateral stretch by drawing an extruded tube over a U-shaped spreader. All methods which cause the stretching to be done at high temperature result in only minor changes in the physical properties, but polystyrene is by nature so brittle that much longitudinal stretching in such articles as tubing or extruded shapes makes them very prone to cracking longitudinally. Any considerable degree of longitudinal stretch in large, heavy-gage, extruded sheets makes them very difficult to handle or cut to length after manufacture.

If, however, the extrusion is stretched laterally as well as longitudinally, the strength is increased in both of these directions, and the reduced strength lies in a direction straight through the thickness of the sheet where no outside forces can act upon it. Only in the case where the stretch is carried on to the limit in both directions does the sheet exhibit a tendency to break up into laminar layers like mica when sheared or punched.

Bilateral orientation is difficult to visualize. The long molecules do not change the angle of their shadows or projections with either the length or width of the sheet. They simply turn into a position more nearly parallel to the surface, and this angular change is proportional to a function of the change in area of the sheet produced by the stretching. It can be shown that in the absence of relaxation a stretch in each direction of three times (200% increase) will give nearly optimum orientation. In so far as mechanical considerations and production requirements demand that the operation be done at higher than optimum temperatures, there is some practical improvement in carrying the stretch to greater ratios.

In the Plax method the extruded sheet is first run through a series of metal rolls that are held at about 158° F. These rolls cool the sheet rapidly and by friction act as hold-backs to permit tension to be applied to the sheet. The sheet next passes through an oven held at about 255° F., which permits the still hot center to cool down while the chilled surfaces are reheated. The side grippers in the stretching oven take the sheet away at a rate of 2½-3½ times its delivery to the oven so that it undergoes a longitudinal stretch of a corresponding amount before reaching the stretching oven. In the stretching oven it is drawn laterally to about three times its extruded width. The temperature in the stretching oven varies from about 240° F. at the start, 250° F. in the middle, to 175° F. at the exit. After cooling in air, the edges are trimmed, and the sheet is wound on cylinders. The temperatures given above are for average conditions. Hard molding powders necessary for thick, tough sheets require temperatures 10-20° F. higher; while soft powders may run 10° F. lower. The whole machine must be carefully shielded from drafts and well-insulated to preserve uniform temperature conditions.

It has been found that the strength obtainable is related to the thickness of the sheet just as it is in monofilaments. Typical strengths are given in Table 2.

TABLE 2. TYPICAL STRENGTHS OF POLYFLEX SHEETS

Thickness, Inch	Longitudinal Strength, P.S.I.	Lateral Strength, P.S.I.
0.015	7,500-8,000	8,500-9,500
0.010	8,000-9,000	9,000-10,500
0.005	9,000-10,000	10,000-13,000
0.001	9,500-10,500	12,500-17,500

Laminated Polyflex Sheets

If Polyflex sheets are stacked in a laminating press and pressed at 240-2 0° F. with a pressure of 200-300 p.s.i. and then chilled rapidly, very little orientation will be lost, and a remarkably tough sheet is produced. Such sheet is suitable for many applications which require screw fastenings and must carry considerable stress. The impact strength of these sheets is much higher than that of molded polystyrene if the lamination is done at low temperature. In this case the piece absorbs energy by delaminating and bending. If, however, it is tightly laminated, it breaks with a clean fracture and is only about twice as strong as molded sheet.

The ability of laminated Polyflex to carry load is well illustrated by Figure 5, which shows the creep in flexure over a loading time of three years. The long-time strength is well over 5,000 p.s.i., and tests in flexure on the original material gave a strength of 17,8 0 p.s.i. Some pieces removed after being under 5,000 p.s.i. load for three years gave a strength of 9,400 p.s.i. in spite of the fact that crazing had progressed nearly half-way through the pieces.

Flexural strengths of laminated Polyflex sheet, as commercially supplied, vary from 14,000-18,000 p.s.i. Similar sheets, press polished from extruded sheets, normally give flexural strengths of 7,0 0-10,600 p.s.i.

Elastic Memory and Unmolding

If a piece of polystyrene is completely relaxed, it will remain dimensionally stable at any temperature unless outside load is

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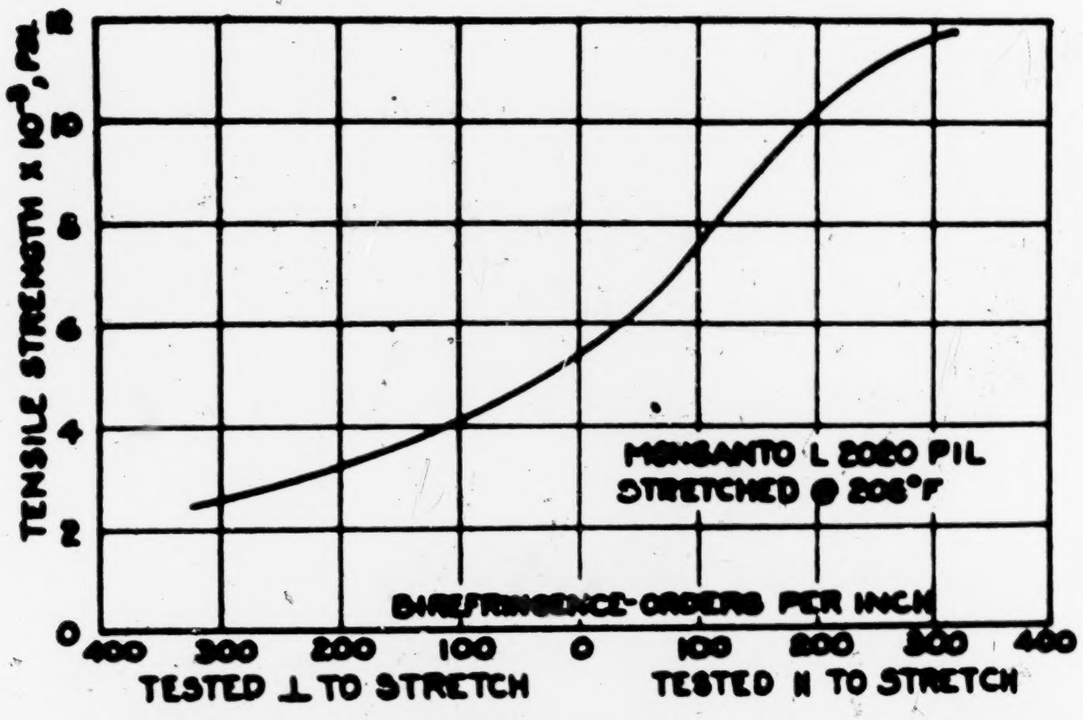
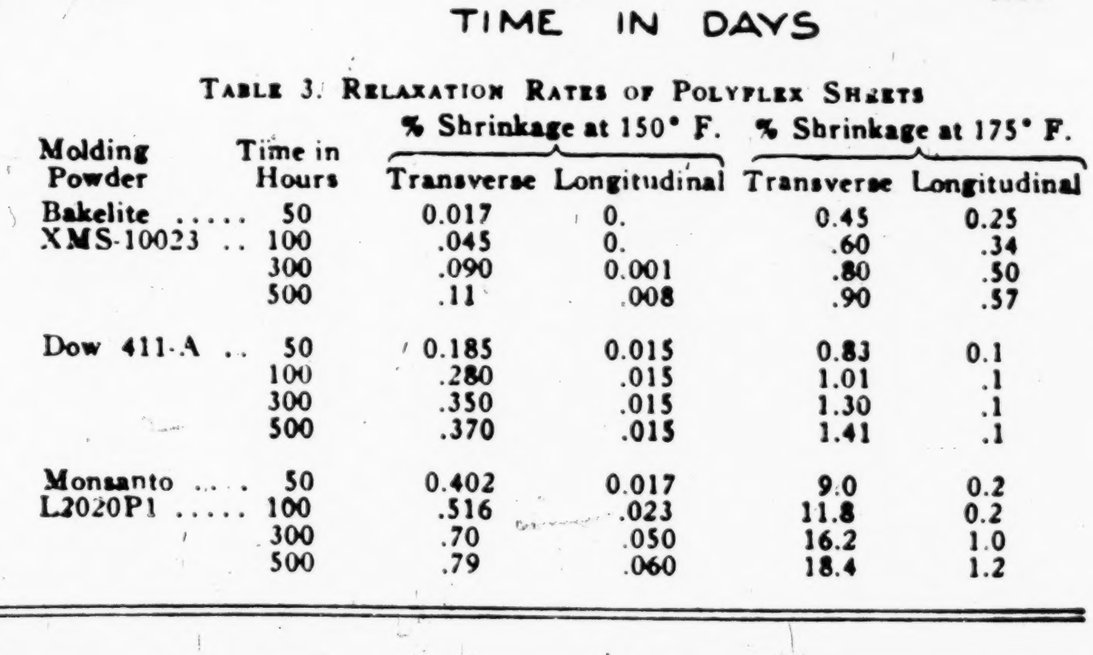


Fig. 3. Relation between Strength and Birefringence in Monsanto Polystyrene



(Right)
Fig. 5. Creep in Flexure of Polyflex Sheet with Various Loadings

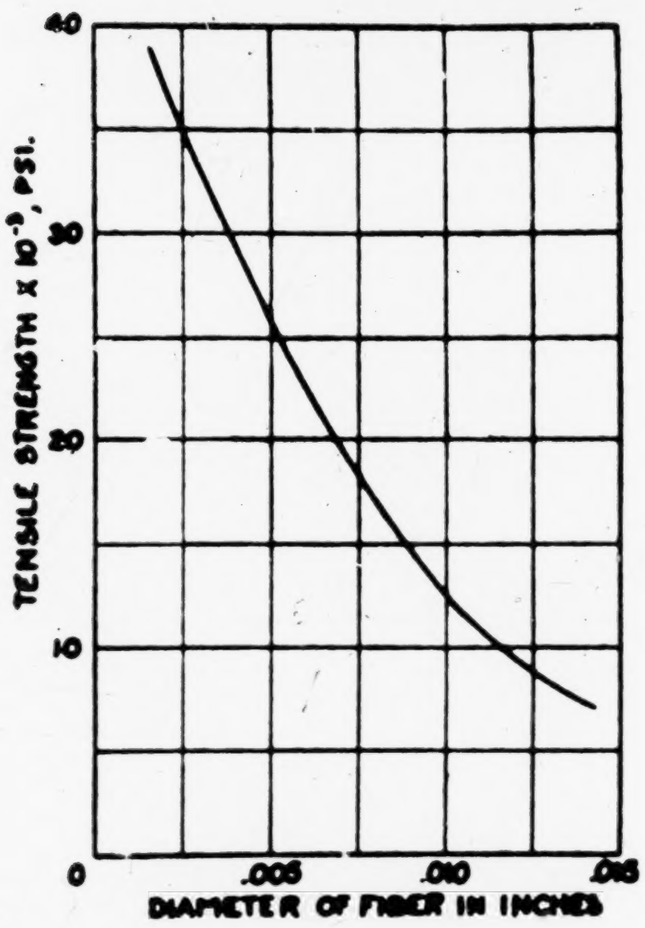


Fig. 4. Relation between Strength and Final Diameter of Stretched Polystyrene Fiber

TABLE 3. RELAXATION RATES OF POLYFLEX SHEETS

Molding Powder	Time in Hours	% Shrinkage at 150° F. Transverse	% Shrinkage at 150° F. Longitudinal	% Shrinkage at 175° F. Transverse	% Shrinkage at 175° F. Longitudinal
Bakelite	50	0.017	0.	0.45	0.25
XMS-10023 ..	100	.045	0.	.60	.34
	300	.090	0.001	.80	.50
	500	.11	.008	.90	.57
Dow 411-A ..	50	0.185	0.015	0.83	0.1
	100	.280	.015	1.01	.1
	300	.350	.015	1.30	.1
	500	.370	.015	1.41	.1
Monsanto	50	0.402	0.017	9.0	0.2
L2020P1	100	.516	.023	11.8	0.2
	300	.70	.050	16.2	1.0
	500	.79	.060	18.4	1.2

applied. If, however, it has been stretched, it tends to resume its relaxed shape and will contract as soon as its temperature is raised to the point where mobility starts. Some of our experiments indicate that the internal forces due to orientation may be equivalent to an external stress of 150 p.s.i. The oriented material therefore behaves like a test piece loaded to 150 p.s.i. and will contract slowly at a temperature considerably below the transition temperature.

The exact temperature at which this long, slow creep commences and the magnitude of the creep both depend primarily upon the "hardness" or softening point of the material. They can be somewhat reduced by slightly relaxing the sheet as a last step in the manufacturing process. This creep is important only in applications where dimensional stability is required in the region above 150° F.

Table 3 shows the rate of relaxation for Polyflex sheets made from one soft and two hard molding powders.

It can be seen that it is important from the user's standpoint that he obtain sheet made from the proper molding powder if he is interested in dimensional stability above 150° F.

Auto Molding

The tendency for Polyflex sheet to unmold may be used to advantage in a process called auto molding. In a typical case, a cylinder eight inches in diameter and 12 inches long was made by this process. Polyflex sheet was wound on a mandrel until the desired wall thickness was secured. The sheet was secured with Scotch tape, and the assembly slipped inside a steel cylinder. The whole was then placed into an oven at 220° F. One end was insulated by a blanket or other shield so that heating progressed slowly from one end toward the other. Under these conditions the heated portion of the sheet shrinks and becomes thicker radially until it forms tight contacts with both the mandrel and the outside cylinder.

The contracting pressure may be as high as 150 p.s.i., as previously stated, so that all air between the sheets is squeezed out and the contracted portion is securely locked in place by friction. As the heated zone progresses along the cylinder, the cooler part of the sheet is drawn into the free space between the mandrel and outside cylinder, and finally a solid, tough, air-free, laminated cylinder is formed. Such cylinders can be made on a wooden mandrel with the outside of the mold made of rolled sheet steel secured against bursting by a strong bolted flange. Close dimensions require machining of the surfaces after baking.

Many objects of large size and enhanced toughness can be made by this method. Its chief advantage is that mold expense is held to a minimum.

Relaxation as a Record of the Manufacturing Process

Because of the elastic memory, it is possible to shrink back oriented polystyrene articles to almost the shape the material had in its molten state. When the stretching is done on a falling temperature cycle, as is very often the case, the specimen will go through the steps of the manufacturing cycle in reverse as it is slowly heated. This process constitutes an amusing and instructive experiment on many molded articles. Plax Polyflex sheet is stretched longitudinally and laterally, with a total area expansion of about nine times. When a square piece of this sheet is slowly heated in ethylene glycol, it shrinks faster in the lateral direction and becomes oblong in shape; as the temperature increases, the oblong gradually changes back into a square.

If the fibers whose strengths are given in Figure 4 are reheated at a series of temperatures, they shrink back to about one-twentieth of their length. This change means that some mechanisms within the material must be capable of operating over stretch ratios of at least 20:1 and is a strong indication that the molecules, especially the longest ones, must be helical or zigzag in shape, and that orientation takes place by stretching the molecules into a longer shape in addition to turning them around into a position more nearly in line with the stress.

It will be found that a 10-inch long piece of the 0.0035-inch fiber shrinks to 1.3 inches in five minutes at 110° C., to 0.75 inch at 130° C., to 0.6-inch at 150° C., and to 0.4-inch at 175° C. A 10-inch long piece of the 0.010-inch diameter fiber shrinks to 3.7, 2, 1.3, and 0.6 inches, respectively, at these temperatures. This condition indicates that the orientation which contributed to strength occurred almost entirely during the temperature interval between 110° C. and room temperature.

Use of the Polariscope

The polariscope has been exhaustively treated in several publications.[8] The most

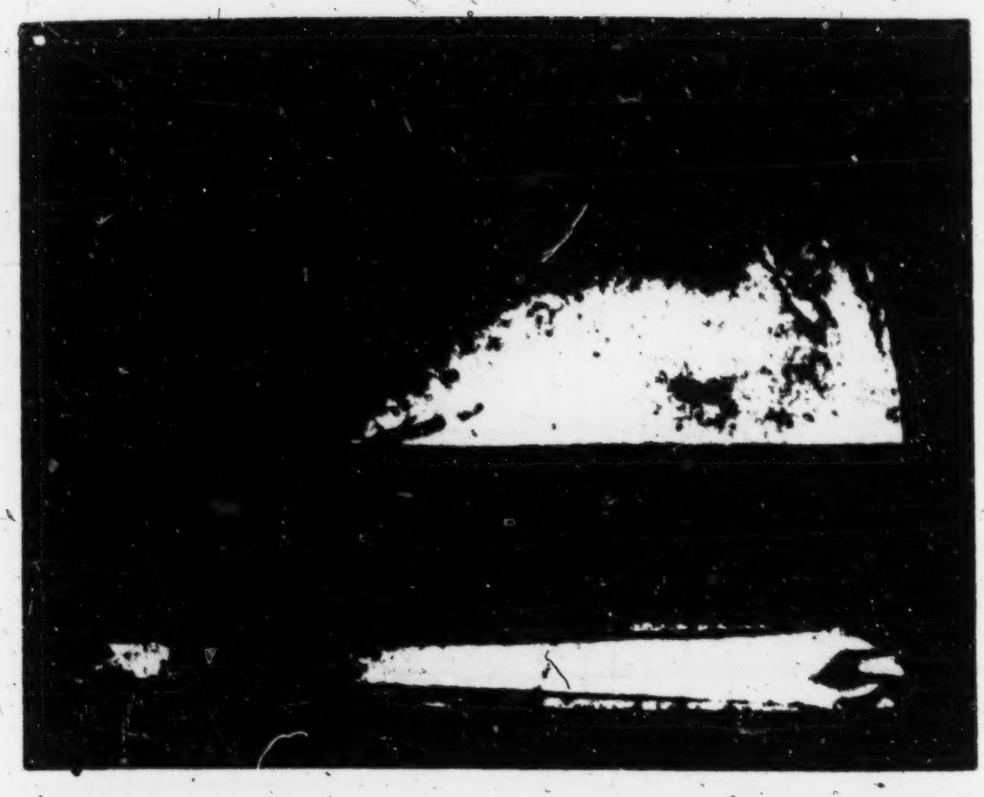


Fig. 6. Top and Sectional Views of Strains Produced in a Disk Made by Pressing a Ball of Hot Polystyrene between Parallel Plates

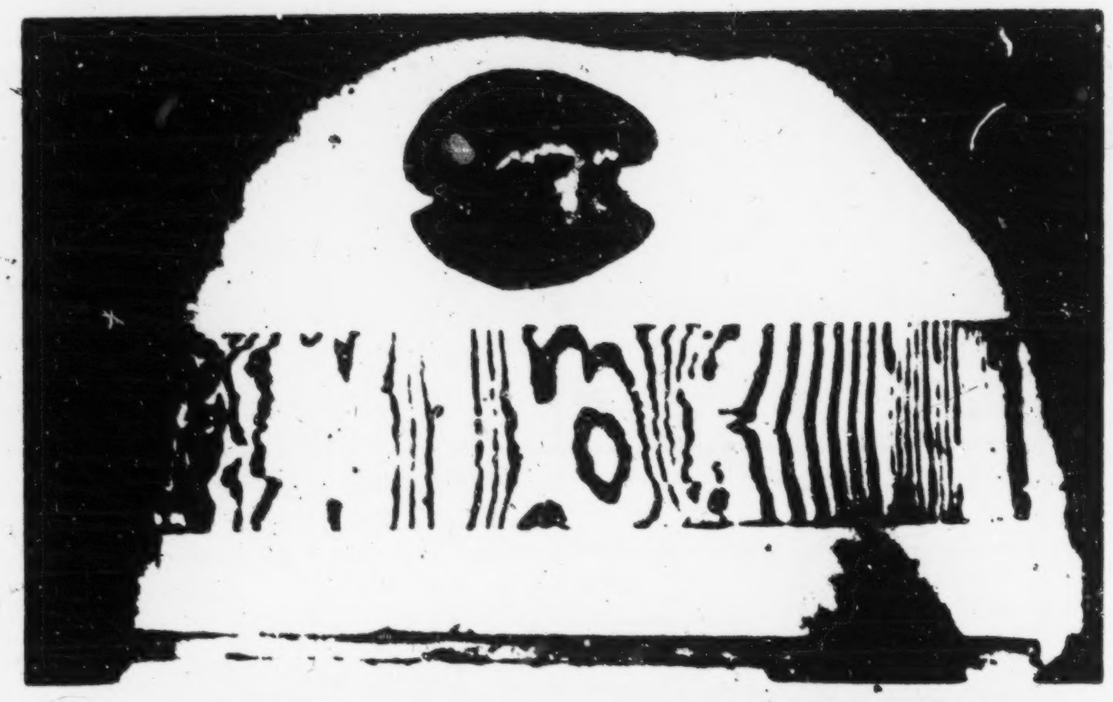


Fig. 7. Top View *(Center)* and Edge Section View *(Bottom)* Showing Strains Produced by Pressing a Cylindrical Polystyrene Extrusion; Section through the Unmolded Portion of the Slab Is Also Shown *(Top)*

convenient type for studying small strains consists of a light source, a Polaroid plate acting as a polarizer, another Polaroid plate set at right angles so as to extinguish the light, and a set of optical wedges. These wedges can be made from stretched polystyrene, as will be described later, or can be purchased in the form of calibrated quartz wedges. For higher orders or more accurate measurements a Babinet compensator is convenient.

A piece of strained or oriented plastic placed between the Polaroid plates gives a pattern of black lines and colors which indicates the strain, its direction, and its degree, but the relation is complicated and often very difficult to interpret. The polariscope indicates only the difference in strain in the two directions at right angles to the optical path. When no strain differences exist a black field is seen; while differences give a series of bright and dark lines composed of prism colors. A uniform strain all over the piece gives a single color, but a varying strain will give a pattern which may be very complicated and require much study to interpret.

If orientation has been done in one direction only, the interpretation is simple since there are no compound stresses. In such cases the birefringence given in orders per inch of thickness follows the stretching rather closely, except at the higher temperatures where relaxation has destroyed part of the stretch. In this latter case the birefringence is a more exact measure of useful orientation than is the ratio of stretch.

When white light is used, only the first five or six bands (orders) are clearly visible. Beyond this range monochromatic light, compensator wedges, order plates, or a Babinet compensator must be used.

The orders observed for the same strain, either hot stretch or stress, are proportional to the thickness of the piece; hence the reading must be divided by the thickness if one specimen is to be compared to another.

If two exactly identical sheets are each stretched the same amount at the same temperature and cooled, they will be found to have the same birefringence. If one of these is placed on top of the other with the directions of stretch coincident, the birefringence will be doubled. If they are placed so that one of them crosses the other at an angle of 90 degrees, they will neutralize one another, and the reading will be zero where the pieces cross, and this portion will appear to have no strain. This point is important because the strains in molded pieces may be very high, but may consist of compression on the outside surface and tension in the interior, and when viewed in the ordinary manner, the piece may appear to be almost strain-free. Such strains can be analyzed by either heating the piece and watching how it unmolds, or by cutting a section and viewing it through the section in a direction parallel to the original surface. Cutting the specimen does not relieve the strains due to hot stretching since these are frozen into the molecular arrangement by elastic memory.

Having this brief description as a background, we may proceed to the study of a few simple cases.

Orientation by Compression Molding

If a ball of hot polystyrene is placed between parallel plates and pressure applied, the ball will be forced into a pancake shape and the material will flow radially outward. Since the radii diverge, the material must also flow laterally, and it is apparent that any element of the material will be subjected to both radial and circumferential stretching as long as the plates move together. This action places the material in bilateral stretch of the same kind as in the Plax Polyflex sheet, except that the stretching is much less and is usually done at a much higher temperature so that the resulting orientation is much less. A study of the mechanics of this pressing operation indicates that no birefringence is caused when the plate is viewed in a polariscope.

In actual practice the ball of plastic would be hot and the plates cold so that the plastic begins to freeze as soon as it touches the metal. Moreover the pressure on the plastic will prevent the plastic from slipping, and the plastic is, therefore subjected to shear forces during its progress toward the wall of the mold. The stretch pattern will be frozen in wherever the plastic is chilled during stretching. It is obvious that the flow toward the outside will come from the hottest plastic, which is naturally toward the center. Hence the hottest plastic will always be the part which forms the periphery of the expanding pancake. Eventually this will contact the wall of the mold, and further pressure can cause no motion except a very slight taking up of cooling shrinkage.

Figure 6 shows a sector of a disk pressed in the above manner viewed in the direction of pressing, and a section cut along a radius viewed at right angles to the direction of pressing, both in polarized light. Very little strain is shown when looking through the disk despite the complicated strain pattern shown in the section. The frozen-in strains adjacent to the surfaces are plainly shown. The central part of the disk is nearly strain-free because its flow took place at such a high temperature that it almost completely relaxed after the flow stopped. The complicated strain pattern at the outer edge is due to downward movement of the plunger during shrinkage which set up severe strains in the frozen edge.

If this piece were tested, it would be found to have good strength in all directions, except that it might craze near the edges. It would have good dimensional stability, when heated, because the relaxed interior would tend to prevent shrinkage of the tightly stretched outer surface.

If we had started pressing radially a long cylinder of hot plastic, instead of a ball, the flow would be modified. Radial flow could take place around the ends, but near the center of its length the plastic could flow only in a direction at right angles to the length of the cylinder. This condition constitutes stretch in one direction only and will result in high birefringence when viewed in the direction of pressing.

In actual practice the plastic cannot flow along the contacted surfaces, and the maximum flow must take place at the center. Figure 7 shows an edge section view, a top view, and the section through an unmolded portion of a slab molded from a long, hot extrusion done between platens heated to about 230° F. The birefringence produced was about 500 orders an inch. The unmolded section shows almost complete recovery except along the portion which was roughly half-way between the platens and underwent some relaxation.

This slab was very weak, when bent at right angles to the length of the original cylinder of hot plastic, and very strong in the perpendicular direction, as would be expected from the previous discussion of sheet stretched in one direction only. It also showed a tendency to split in laminar manner when bent crosswise.

An experimental piece was made in the same manner except that the platens were cold, and the pressing was done slowly in a hand-operated press. As the plastic hardened, the pressure was increased until it reached about 2,500 p.s.i. The birefringence was very high, and the unmolded

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[8] "Fundamentals of Physical Optics," F. A. Jenkins and H. E. White. McGraw-Hill Book Co., Inc., New York, N. Y. (1937).
"Photoelasticity," N. Alexander. Rhode Island State College, Kingston, R. I. (1941).

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portion showed that the plastic had actually been torn in the central portion of the slab. This appeared as a vertical slot in the center of the unmolded section. A section 0.056-inch thick cut across the axis of the original cylinder of plastic was polished and projected in a polariscope, using monochromatic sodium light. The pattern obtained was so complicated that it was very difficult to get a sharp image at 15-diameter magnification. More than 34 orders of strain could be counted in the original negative, which gives 600 visible orders per inch and many more that could not be seen.

Orientation by Extrusion through a Cylindrical Die

According to the laws of viscous flow the plastic in contact with the die wall does not move, and the velocity of flow increases toward the center so that a row of dots placed across the line of flow at one instant would be arranged in a parabola at a later instant of time. The shear is a maximum at the wall and drops to zero at the center. Under conditions of steady flow all the molecules would be arranged parallel to the wall, with those nearest the wall stretched the most. Polariscope studies of actual extrusions indicate that in practice, probably owing to the high temperature, orientation is much less than might be expected. Much of the relaxation or loss of orientation takes place immediately at the exit of the die where the shear forces necessarily fall to zero. The phenomenon of "puffing up" also changes the mild orientation at the center into a more crosswise direction so that rapidly cooled pieces, such as may be made by extruding into water without much stretching between the die and the bath, show medium high longitudinal orientation with small crosswise orientation at the center. Only in cases where chilling is rapid does the orientation from shear in the die have any importance on physical properties.

Orientation within the die does, however, have an important effect upon flow. In the completely random condition the long molecules are distributed irregularly throughout the mass and tend to reduce its mobility. The ordinary measurements on the viscosity of polystyrene show a marked decrease in the apparent viscosity as the pressure through the die is increased. In some experiments which we made on a series of straight, smooth, round viscosity tubes, doubling the pressure drop through the tube caused an increase of from five to eight times the amount of material forced throug the tube. This decrease in the resistance to flow is in our opinion due to orientation of the molecules parallel to the walls, in which position they glide by each other much more easily. The higher the molecular weight and the poorer the flow, the more orientation effects such as the above are present.

One very high molecular weight plastic extruded through a ¼-inch round die three inches long gave peculiar results. Extrusion under approximately 5,000 p.si. pressure and at a temperature too low for proper melting gave a material that was fibrous and could be easily picked apart. The fibers lay parallel to the surface and in a longitudinal direction, showing almost perfect orientation. At a higher temperature the fibrous structure disappeared, but shear planes developed so that the central portion of the material slipped through a shell of the plastic and issued from the die at a higher speed than the shell. The shell moved along the die more slowly and the final extrusion appeared to

Fig. 8. Rope-Like Structure Developed in Polystyrene by Simultaneous Stretching and Twisting Followed by Lateral Pounding

be a rod surrounded by bell-shaped sections of tubing. In this case the slipping undoubtedly generated local overheating which aided the gliding action. Attempts to melt the tubing-like outer part by using a very hot die gave a zigzag shape. A smooth extrusion was obtained only when the plastic and the die were at the same temperature, the plastic was uniformly melted before entering the die, and the extrusion velocity was held below a certain maximum.

Spider lines are another effect of orientation and are difficult to eliminate in polystyrene extrusions. Often tubing, as it leaves the die, appears to be free from spider lines, but subsequent blowing up to a larger diameter reveals them because the material oriented longitudinally stretches more easily in a lateral direction, as would be expected from Figure 2, and the spider lines blow to a thinner wall.

Surface dullness is also a phenomenon of orientation and occurs as the longitudinally oriented surface leaves the die. The die is stationary, of course, and the plastic is moving. At the very edge of the die the plastic loses the support of the die and is subject to heavy tensile strains. The longitudinally oriented fibers or molecular aggregates have already been strained to the limit by the orienting forces within the die so that they tear in a minute pattern at the die edge. This pattern, because of relaxation is short lived and appears as a matte or dull gloss surface if the extrusion is stiff or rapidly chilled. Viewing such a surface under 50-power magnification, illuminated with incident light, shows that the little surface ruptures have partially disappeared and look like irregular eroded cavities arranged in lines. They are not caused by roughness in the die because the pattern changes along the length of the rod; some lines diminish and disappear; while others form and grow larger. This behavior cannot be seen in the small field of the photomicrograph.

Peculiar Effects Made Possible by Orientation

It has already been shown that longitudinal orientation makes the material very weak crosswise so that the fibers are easily split apart. By combining longitudinal stretching with twisting, orientation in a helix results. The fibers under this arrangement may be split apart, but, if so, are still arranged very much like the fibers in a rope and cannot be separated by tension. Like a rope, however, the whole is flexible and can be wound around objects or tied into knots, as shown in Figure 8.

The four specimens were made by reheating sections of ⅛-inch square polystyrene rod, stretching them to about 10 times their original lengths, and then twisting them by varying amounts; all operations were done at the proper temperature. The twisted rods were held while cooling to prevent relaxation. Part of the twisted portion of each rod was then subjected to mild hammer blows which caused the fibers to crack apart along the lines of weakness. This action changed the hard, rigid rod into a flexible, rope-like material as shown in the illustration. The base of each rod is the original extrusion showing part of the drawn down and twisted portion in its still glass-like condition. The ends of some of the specimens have been forcibly untwisted to show the fibrous nature of the material. The fiberized samples furnish the most vivid demonstration we know of the effects of orientation in polystyrene.

It is evident that the process can be mechanized and that the fibrous structure can be developed by many other methods than controlled pounding. Certain other plastics also respond to the same treatment.

Theoretical Aspects of Orientation

Unilateral Stretching

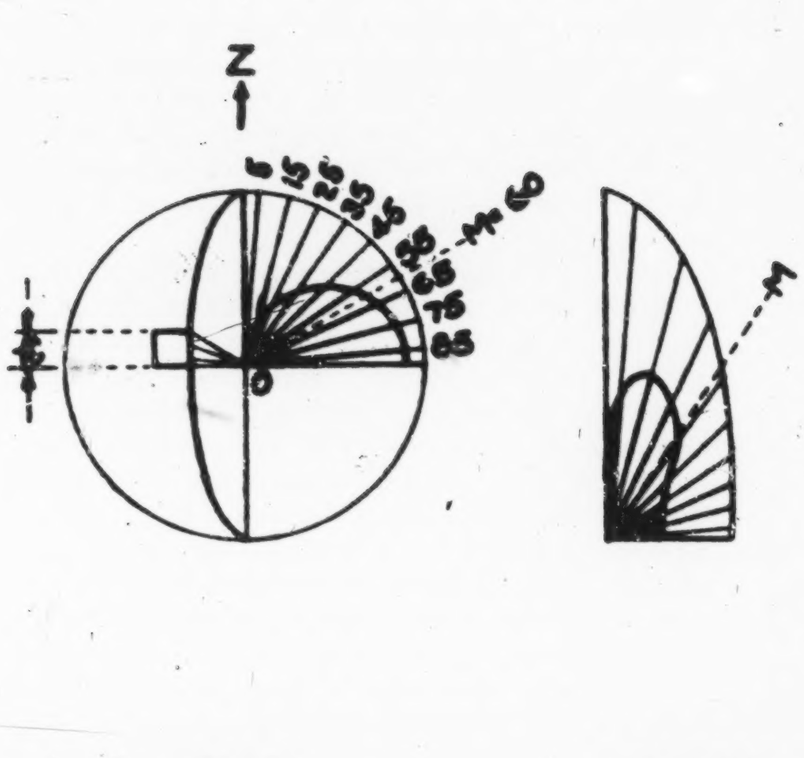
The polystyrene molecule is from 20-200 times greater in length than in width.[8] In this respect it may be treated as a long cylinder. If it is coiled into a helix, this coiling has the effect of reducing the length to width (or diameter) ratio. If we treat the problem as one of rigid cylinders being moved around into more parallel positions by stretching, as would be the case if we were dealing with a system of stiff fibers in a mixture of stiff molasses, an understanding of the problem becomes simple.

Let us select a cube of the material, the edges of which are the X, Y, and Z coordinate axes of space. We are going to stretch the material in the Z direction, but before doing so we must determine the angles of all the molecules with respect to our space coordinates. To do this work we measure the direction of the axis of one molecule and then draw this direction through the center of a sphere so that the direction is strictly parallel to the molecule we selected. We repeat this procedure for every molecule in the cube. The direction of each molecule would pass through some point in the surface of the sphere. Let us place a small dot at this point. If we now look at the sphere from any direction whatever, the dots will be equally spaced if the original cube of material had a completely random structure, and each unit of area on the sphere will contain the same number of dots.

In Figure 9-A such a sphere is shown. The little unit of area marked on its surface is typical. Since we intend to stretch the material in the direction Z, the angle which any molecule has with the OZ direction is important. All the molecular directions in any zone of height, h, may be considered as a unit, and we shall concentrate them on one radius passing through the half height of this zone. Their number

[8] "Frictional Phenomena," Andrew Gemant, *J. Applied Phys.*, 13, 90, 152, 692 (1942).

Defendants' Exhibit 9A



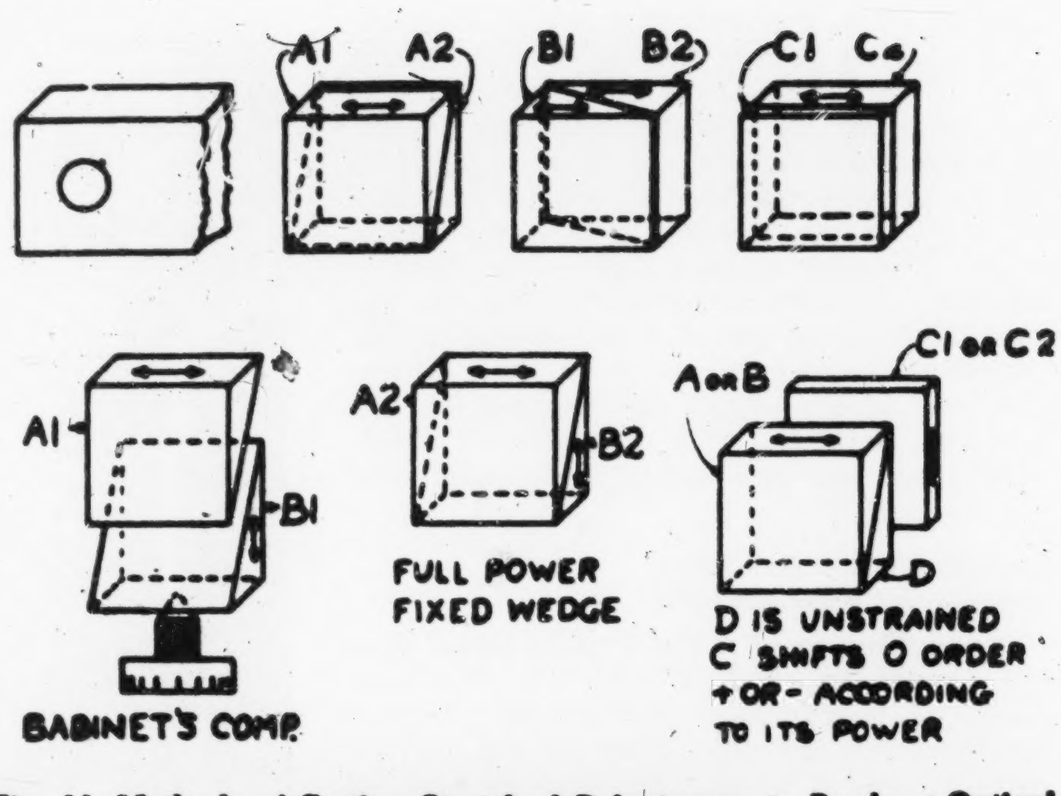
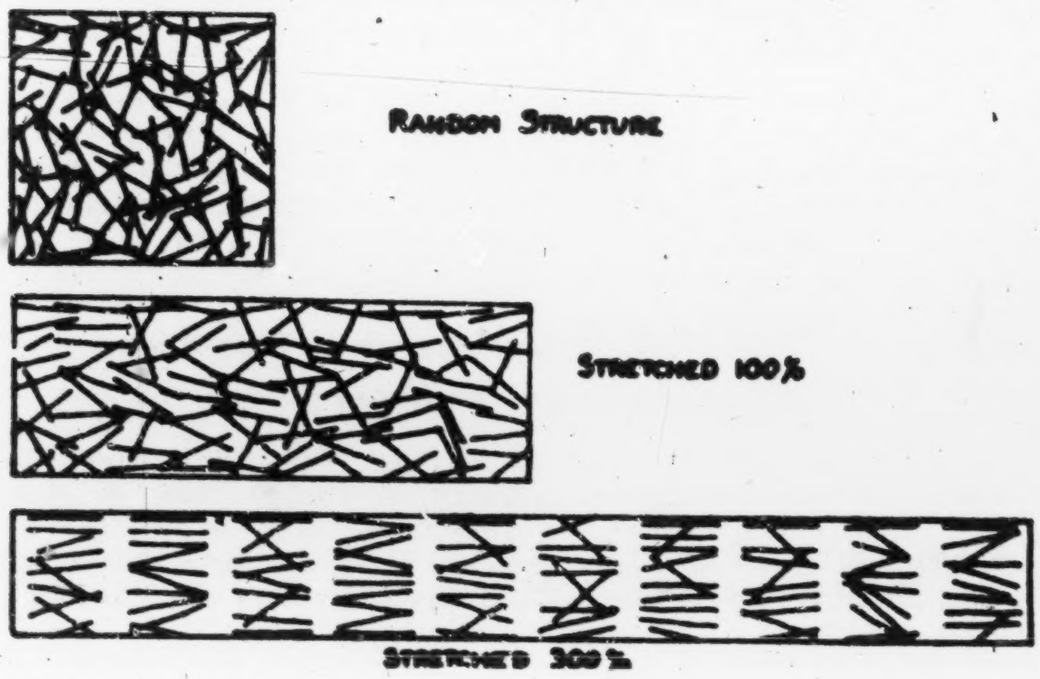


Fig. 11. Methods of Cutting Stretched Polystyrene to Produce Optical Wedges and Order Pla

e = 0 A e = 100 B e = 300 C

Fig. 9. Changes in the Average Axial Directions of Polystyrene Molecules Upon Stretching in One Direction



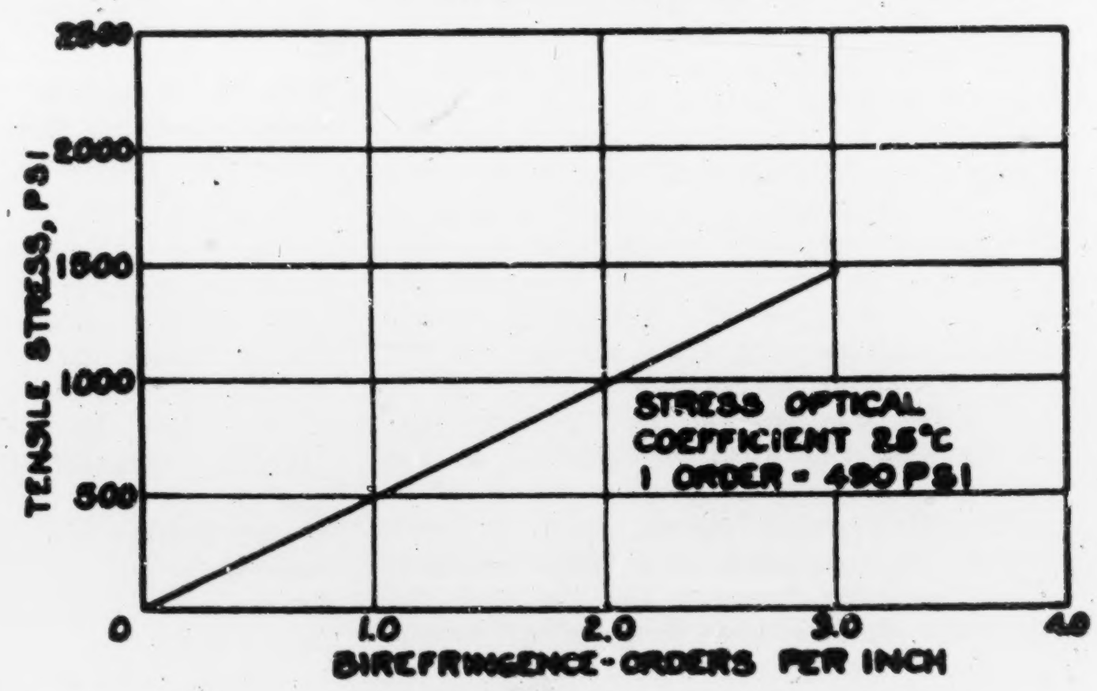


Fig. 13. Stress Optical Coefficient of Polystyrene at 25° C.

BIREFRINGENCE - ORDERS PER INCH

Fig. 13. Stress Optical Coefficient of Polystyrene at 25° C.

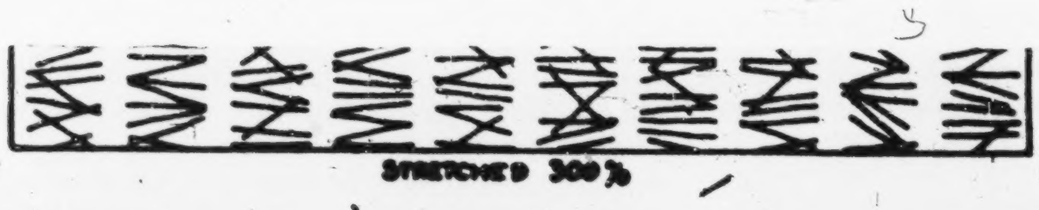


Fig. 10. Representation of Molecular Angular Changes upon Stretching

is, of course, proportional to the area of the zone. An accurate mathematical solution is involved and difficult,[7] but by dividing the surface in 10-degree angular heights an approximate solution, easily visualized, is obtained. Let us cut out a quarter of the sphere and draw the radii from 5-85-degrees in 10-degree steps. Each of these radii is the center of a 10-degree zone, and the area of the zone is proportional to the number of molecules in that zone. We now lay out arrows on the radii the length of which are proportional to the zone area of the sphere, and the lengths of these arrows represent the number of molecules involved in the 10-degree zones. The direction of the arrow gives the average direction in the zone.

If we stretch the cube and the sphere in the Z direction until they are twice as high (stretch ratio $X = 2$), or $e = 100\%$, it can be shown that the directions of the molecules in the stretched cube will still be parallel to the directions in our stretched sphere, which will look like Figure 9-B. Not so many molecules are at or near right angles to the direction of stretching, and where the average molecular direction was formerly 60-degrees to the OZ line, it is now at 31.5-degrees. If we continue the stretching until the height is three times its original radius ($X = 3$), or $e =$ 200%, the sphere will now look like Figure 9-C, and the average direction of the molecule will have moved to a position only 18.4 degrees from the OZ axis. When the stretch is four times, the angle has dropped to 12.2 degrees. It does not appear that continued stretching will add much to the orientation, and indeed Figures 1, 2, and 3 indicate that this is the case when stretching was done at low temperatures.

A more direct picture of the changes in direction of the molecules that take place upon stretching is shown by Mr. Loring's representation in Figure 10.

We cannot overlook the fact that as the strain increases, the tendency to relax increases, and at higher temperatures, where mobility is greater, the viscous flow and high rate of relaxation will limit the amount of residual orientation which can be left in the cooled piece. In such cases the birefringence is a much better measure of the orientation than is the hot stretch ratio.

In Figure 4, however, we have strengths running up to 35,000 p.s.i. and an unmolding ratio of 20:1. We cannot explain this state of affairs in a satisfactory manner except to say that because of the rapid stretching and the small diameter of these fibers the molecules must have been straightened from a zigzag or helical shape into more elongated shapes, with the result that more of the load is thrown directly on the carbon-to-carbon linkages and less on the weaker Van der Waal's forces.

Biaxial Stretching

A treatment similar to the above will show that when equal stretching is done in two directions at right angles, a projection of the molecules remains unchanged on the face of the piece in the third direction, but its angle with the face is rapidly reduced. For example, let the angle of a molecule in a slab be 60 degrees with the face of the slab. The angle after stretching without any relaxation will be changed as shown in Table 4.

TABLE 4. ANGULAR CHANGE UPON STRETCHING

e	X	Angle A
0	1	60°
100	2	12° +
200	3	3° +
300	4	1.5° +

where: e = % increase in length and in width.
X = ratio between stretched length or width and original length or width, respectively.
A = minimum angle between the axis of the molecule and the face of the plate.

It appears that very little is to be gained by stretching Polyflex more than to nine times its original area, and experience indicates that this condition is true in the thicker gages. However, just as fine fibers seem to develop unexpected strength by long stretching, so also does thin Polyflex sheet. Such thin sheets in gages of 0.0015-inch and under develop strengths up to 17,000 p.s.i. which cannot be obtained in the heavier sheets. These thin gage sheets show cold stretching up to 50%, and figures up to 60% are not uncommon.

Polystyrene Optical Wedges

When fully annealed and relaxed poly-

[7] Our laboratories with the assistance of Samuel J. Loring, consulting engineer, are attacking the problem of working out a correct mathematical solution to the effect of orientation on strength which is hoped may furnish the subject of another paper.

styrene is stretched at a low temperature (210-230° F.), it develops optical birefringence which is nearly proportional to the amount of % elongation. By suitable cutting of such pieces compensator plates and wedges of any desired power can be made. We have made and used such wedges for a number of years. Since the process is simple, it is described there as one of the interesting results of orientation.

A simple apparatus for stretching polystyrene consists of a steam box heated by boiling water, the steam from which rises through a series of holes into the oven. A good piece of polystyrene slab is placed through the oven, and one end secured by a swivel joint. The other end of the slab is similarly secured to a cable. The joints must be carefully centered so that the polystyrene will not bend as it stretches. A load applied either by weights or a windlass is arranged so that it can be applied when the piece is thoroughly and uniformly heated.

For a 1/16-inch thick piece the heating period should be at least five minutes after a thermometer in the box indicates 212° F. A slab ½-inch thick should have a heating period of about 20 minutes. After this, the load is applied until the piece has stretched from 50-100% and is then reduced until no more stretching results. The reduced load is left on during the cooling period, which is best done by blanketing the box, shutting off the heat, and allowing the whole to cool down normally. When the interior temperature has dropped to about 120° F., the piece may be removed from the oven and cooled in air.

Both ends of the piece will be enlarged, but the center length will be of substantially uniform size. This portion may then be cut into the shapes and sizes of wedges shown in Figure 11. The power of the wedge depends on the amount the polystyrene was stretched and on the difference in thickness between the thin side and the thick side of the wedge, as, for example, in A1 and B1 in the illustration. When the two wedges have exactly the same shape, they will neutralize each other along the center, and a black line will be seen at this point when viewed in a polariscope. A series of parallel lines showing spectral colors will appear on either side of this black line. In white light only five to six lines on each side will be clearly visible, but in monochromatic light, as with sodium or filtered mercury vapor lamps, the whole surface will be covered with bands. In general 10 bands on each side are enough, and calibrated order plates, such as C1 or C2, are used to change the order. Low-power wedges are useful on thin pieces, and high-power wedges are useful for rough measurements on thick or highly strained pieces.

Two precautions should be taken when making these wedges. Polystyrene is soft, and its surface easily cold flowed by frictional heat and pressure. Sawing should be done with a sharp saw flooded with water. Grinding should be done with sharp, clean, waterproof sandpaper, also flooded with water. A sharp scraper may be used in "hogging down," but all the lines and roughnesses produced should be ground out. From time to time the power of the wedge and its characteristics can be checked by covering the dried surface with Nujol and a cover glass and viewing it under polarized monochromatic light. The lines should be straight since, if they are wavy or zigzag, the polystyrene is not homogeneous, and a good wedge cannot be made from it. Visible, fine, sharp jumps are probably due to scratches on the surface and must be ground out.

The diagonal surface must be accurately flat so that it can be cemented on to its backing compensator wedge. Thin wedges require a stiff backing plate during grinding and polishing. We have found that stiff glue makes a good temporary bond. When desired, the piece may be pushed off and the glue washed away with water.

Polystyrene is crazed by most solvents. The two wedges, A1 and B1, may be cemented together with ordinary turpentine varnish, or may be clamped together and heat sealed at the corners with a hot iron. Acetone, amyl acetate, and similar solvents must never be used because they will cause clouding of the wedge within a few weeks.

The birefringence put into polystyrene by hot stretching is opposite in sign to that developed by cold stretching. This condition has no significance in the use of the wedges, but it must be born in mind when the wedges are used to analyze strains. Some of the peculiar edge effects in molded and stretched extruded shapes are due to changes in the stress optical coefficient near the transition point.

Figure 13 shows the appearance of a piece of square polystyrene rod bent at 212° F. (in boiling water) and then cooled. Another piece of the same rod was loaded by a strut and placed to the right side of the first piece over the same wedge. The left side (convex) in each piece is the tension side; yet the slope of the lines is opposite in the hot bent and cold bent pieces. Stated otherwise, hot tension shifts the bands in the opposite direction (downward).

The stress optical coefficient for polystyrene at room temperature is shown in Figure 12. It is 490 p.s.i. per order (band) per inch of optical path (thickness). The birefringence-stress curve is a straight line up to about 1,500 p.s.i. stress, after which crazing and cold flow may start. The coefficient, being associated with strain, varies rapidly with temperature as the polystyrene softens.

Summary and Conclusions

Orientation is the cause of many of the peculiar properties of polystyrene.

It may be advantageous or detrimental, depending on its amount and direction and the article.

Orientation and the associated birefringence enable much useful information on the manufacturing process and the strength of the article itself to be gathered from a study in the polariscope.

The mechanism of orientation is not completely understood, but it is believed that considerable useful information has been gathered.

Very small fibers and very small sheets seem to possess inordinately great strength.

Cold stretching up to 60% in thin sheets and 80% in small fibers may be developed by hot orientation and controlled relaxation, but such pieces do not show maximum strength.

Acknowledgments

The author wishes to acknowledge the helpful assistance of the various members of the Plax laboratories who spent much time in preparing the data which furnish the basis of this paper. Acknowledgment is also made to J. M. DeBell for assistance and helpful criticism, and to Samuel J. Loring for his mathematical analyses which lead to Figures 9 and 10.

Fig. 13. Strains Produced in Polystyrene Rod by Hot Stretching *(Left)* and Cold Stretching *(Right)*

Plastic Foam Material

U. S. FLOTOFOAM, a plastic foam insulating material that combines exceptionally low thermal conductivity with very light weight, is produced by United States Rubber Co., New York, N. Y., for low temperature installations. Present applications include commercial and home refrigeration units and shipping containers for fresh and frozen foods, and other practical uses include transportation refrigeration in all types of carriers. The material is also suitable for flotation purposes, for soundproofing, and for display and novelty uses. Its insulating properties are such that walls in installations can be made thinner to increase storage capacity, and the foam is non-corrosive, non-toxic, self-extinguishing, will not support mold or bacteria growth, and holds its insulating value over a wide range of mean temperatures.

The snow-white plastic foam is available in shredded and block forms weighing 0.8-1 and 0.8-1.5 lbs./cu.ft., respectively. Both blocks and slabs can be made in a variety of sizes and shapes to fill cavities and can also be surfaced with paper, cloth, or resin coatings. The shredded form can also be supplied in individual containers ready for installation. Flotofoam is made from a combination of soluble resins processed first into a liquid, then into a froth, jelled permanently set, and finally dried. The material consists of less than 1% solid and over 99% air. The thermal conductivities of the shredded and block forms over a mean temperature range of 9-100° F. are 0.173-0.208 and 0.20-0.23 BTU/hr/sq.ft./°F./in., respectively.

Defendants' Exhibit 16

MEMORANDUM

COPY

TO Mr. William L. Searles DATE May 20, 1954

SUBJECT Summary of Conference on May 12 in the New York Office with Mr. Howard J. Churchill and Mr. Freeman of Churchill, Rich, Weymouth and Engel

COPIES TO

In paragraph three of the subject report is a request for samples of labels used prior to 1945.

The first caution labels on Tenite drums appeared in three places, on the tops of the drums, at the bottom of the packing slip and at the bottom of the identification label pasted to the side of the drum, these latter two being identical.

The label on the top of the drums was in red and read "To prevent contamination KEEP DRUM COVERED any foreign material will spoil molded articles". It is believed this label was adopted in 1942 but was most surely used in 1945 and until 1953.

Six photostat copies of a packing slip actually used and dated 1945 accompany this memo. It is the best recollection of those concerned that this label was instituted in 1942 and continued until July, 1953 when we adopted the terms Tenite Acetate for Tenite I and Tenite Butyrate for Tenite II at which time the labels, packing slip forms etc. were changed.

In connection with the request referred to in paragraph three, page 2 of the conference notes, in "Tenite Molding",

Defendants' Exhibit 46

edition 5A, copyright, 1940 there is stated on page 4 the following:

> "It should be noted that Tenite I and Tenite II cannot be mixed in molding. Since the two plastics are incompatible, the scrap from each must be kept separate in order that it may be molded again."

We are sending you two copies of the red label, two copies of the 1940 edition of "Tenite Molding" and the six photostat copies of the packing slip. I am assuming you will be dividing this material between Mr. Churchill and Mr. Fisch, or his attorney, as well as telling them both any further testimony you may be able to make to the extent that the information in this memo may refresh your memory.

Spencer E. Palmer (Sgd.)

Defendants' Exhibit 27

THE MOLDING MATERIAL IN THIS DRUM IS BASED ON CELLULOSE ACETATE.

CAUTION

DO NOT MIX WITH ANY OTHER PLASTIC. FAILURE TO COMPLY WILL RESULT IN LAMINATION, BRITTLENESS, SKINNING OR SCALINESS.

CELANESE CORPORATION OF AMERICA

Opinion

Civil Action No. 285—51

Appearances:

OTTO COOPER, Esq.
Attorney for Plaintiffs

GREENE, PINELESS, CALLMANN & DURR, Esqs.
(N. Y. Bar) By: Orville N. Greene, Esq.
Of Counsel

SMITH, SLINGERLAND, TRAUTH & HOLTZ, Esqs.
Attorneys for Defendants By: David Trauth, Esq.

CHURCHILL, RICH, WEYMOUTH & ENGEL, Esqs.
(N. Y. Bar) By: Howard J. Churchill, Esq.
and Robert M. Freeman, Esq.

MODARELLI, District Judge.

This is a patent action. Plaintiffs are Richard A. Fisch, who is the assignee of Patent No. 2,531,234 for "Longitudinally Separable Extruded Thermoplastic Strip and Process of Producing Same,"[1] and Anchor Plastics Co., Inc., Fisch's exclusive licensee of the patent. The application for the patent was filed on July 21, 1949, and issued on November 21, 1950, to Peter H. Seckel. Plaintiffs allege that William Gould, trading as Stay-Rite Supply Co., and Keystone Plastics, Inc., are infringing the patent by making, using, and selling strips embodying the patented invention and by employing a process for producing the

[1] "The thin strips are very useful as corset stays and similar stiffeping reinforcements for ordinary or protective wearing apparel or in any material which is apt to be subjected to repeated flexing." Col. 2, line 15. "* * * the strip will withstand an unusual number of * * * severe flexings without separating." Col. 3, line 23. Commercially, the product has been marketed as a brassiere stay known as "Bonar.

material embodying the patented invention. Plaintiffs demand that defendants be enjoined from infringing and that plaintiffs receive an accounting and damages. The defense is that the patent is invalid for lack of invention; defendants also counterclaim for damages based upon alleged unfair competition by plaintiffs in threatening to sue defendants' customers for infringement.[2]

At the beginning of the trial, plaintiffs limited their charge of infringement to Claims 2 and 7 of the patent. The counterclaim, however, requires an adjudication of all of the claims except numbers 3 and 6, which the parties agree are not involved. Since defendants admit infringement, the only issue is whether Claims 1, 2, 4, 5, and 7 are valid.[3]

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[2] Defendants concede there is insufficient evidence to support their counterclaim; they contend, however, that "Plaintiffs' conduct * * * of trying to dissuade the defendants from contesting the same [this action] by threats against customers, a separate suit against a customer, by notices to the trade and suggestions of disproportionate litigation expenses—having in mind that the patent in suit covers something which is completely devoid of novelty and invention—shows bad faith and warrants the award of counsel fees to defendants under 35 USCA 285." Defendants' Proposed Findings of Fact and Conclusions of Law No. 29.

[3] "1. A process of producing strip material which has a homogeneous appearance but separates into a plurality of filaments when sharply bent comprising the steps of mixing two non-compatible, fiber forming, linear-polymeric, thermoplastic materials, plasticizing said mix, and forcing the mix containing two separate solid phases through a single orifice die and withdrawing the extruded product from the die without substantially stretching the same whereby a unitary product consisting essentially of two distinct series of parallel threads adhered together is obtained.

"2. A process of producing strip material which has a homogeneous appearance but separates into a plurality of substantially parallel filaments when sharply bent comprising the steps of mixing cellulose acetate with cellulose acetate butyrate which is non-compatible with said cellulose acetate, plasticizing the mix, and forcing the mix containing two separate solid phases through a die, one phase of said mix comprising a solid fiber-forming material consisting essentially of cellulose acetate and the other phase comprising a solid fiber forming material consisting essentially of cellulose acetate butyrate.

"4. As an article of manufacture, an extruded longitudinal strip of thermoplastic material, having a homogeneous appearance but actually comprising two chemically distinct solid phases, each of said phases consisting essentially of a fibrillar, linear-polymeric, thermoplastic material which has a similar

Opinion

The objects of the patent are: (1) To provide a process for manufacturing a length of extruded material; (2) having unusual longitudinal tensile strength and unusual resistance to tearing transversely with respect to the direction of extrusion; (3) which is easily separable into threads running parallel to the length of the material; and (4) having a very high resistance to breaking as a result of repeated flexing. "These objects and others ancillary thereto are obtained by adding two or more incompatible thermoplastic, fiber-forming linear-polymeric compositions[4] to an extruding machine and extruding the two materials to form a unitary product.

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melting point but which is incompatible with the thermoplastic material of the other phase even when melted, the linear alignment of the individual fibers of each of said thermoplastic materials being substantially parallel and said strip having a substantial thickness whereby when the strip is bent sharply at any point the phases separate into a plurality of layers each containing a multiplicity of filaments, said product being substantially unseparable transversely thereof beyond the filamentary stage by any operation involving only the repeated bending of the strip.

"5. As an article of manufacture, an extruded longitudinal strip of thermoplastic material, having a homogeneous appearance but actually comprising two chemically distinct solid phases, each of said phases consisting essentially of a fibrillar, linear-polymeric, thermoplastic material which has a similar melting point but which is incompatible with the thermoplastic material of the other phase even when melted, the linear alignment of the individual fibers of each of said thermoplastic materials being substantially parallel to the length of the strip and said strip having a substantial thickness whereby when the strip is bent sharply at any point the phases separate into a plurality of layers each containing a multiplicity of filaments, said product being substantially unseparable transversely thereof beyond the filamentary stage by any operation involving only the repeated bending of the strip.

"7. As an article of manufacture, an extruded longitudinal strip of thermoplastic material, having a homogeneous appearance but actually comprising two solid phases, one of said phases consisting essentially of cellulose acetate, the other of said phases consisting essentially of cellulose acetate butyrate, said two cellulose derivatives of the two phases being incompatible with each other and each having a fibrillar structure, the linear alignment of the individual fibrils of each of said cellulose derivatives being parallel and said strip having a substantial thickness whereby when the strip is bent sharply at any point the phases separate into a plurality of layers each containing a multiplicity of filaments said product being substantially unseparable transversely thereof by any operation involving only the repeated bending of the strip."

[4] The example set forth in the patent and Claims 2 and 7 disclose the use of cellulose acetate and cellulose acetate butyrate.

> "At least two of the thermoplastic materials which are extruded must be fiber-forming material * * * and must be incompatible. Apparently any two of such fiber-forming thermoplastic materials that are incompatible can be employed although it is obvious that the plasticizing temperatures of the two materials should not be too far apart. The proportions of the incompatible materials are not very critical, the proportion of either one can vary from about 5% to 95% or more, of the mixture. The best mixture so far found is 40-60% of cellulose acetate with 60-40% of cellulose acetate butyrate." Col. 1, line 44.

As set forth in the patent, the process is that a mix comprising two incompatible thread-forming plastic materials is extruded through a die to form a strip, which can be separated longitudinally into a plurality of threads or filaments. Is such a process patentable as a new and useful process, or composition of matter or improvement thereof?[5] Does the patent show "'more ingenuity * * * than the work of a mechanic skilled in the art [citing cases].'" *Sinclair & Carroll Co.* v. *Interchemical Corp.*, 325 U. S. 327, 330 (1945), cited in *Modern Art Printing Co.* v. *Skeels*, 223 F. 2d 719 (CA 3 1955). Has there been "* * * an innovation for which society is truly indebted to the efforts of the patentee. * * *." *Sinclair & Carroll Co.* v. *Interchemical Corp., supra*, 330.

Defendants argue that when Seckel mixed cellulose acetate and cellulose acetate butyrate[6] and extruded it to

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[5] 35 U. S. C. A. §101.

[6] Commercially, they are known as Tenite I and Tenite II. Tenite I is a cellulose acetate molding composition sold by the Tennessee Eastman Company since 1934. Tenite II is a cellulose acetate butyrate molding composition sold by the Tennessee Eastman Company since 1938.

produce a longitudinally fibrous product his process and product resulted from knowledge obvious to a person having ordinary skill in the art.[7]

Any extrusion of cellulose acetate by itself or of cellulose acetate butyrate by itself always results in a product which is devoid of internal fibers; never, when extruded alone, is the mono-filar filament (non-fibrous) of cellulose acetate or of cellulose acetate butyrate inherently or internally fibrous. The patent discloses that when a mixture of cellulose acetate molding powder and cellulose acetate butyrate molding powder is plasticized[8] and extruded through a single die orifice, the extruded strip automatically and inherently is internally fibrous. From these facts, plaintiffs conclude that the internal fibrous character of the extruded mixture is an amazingly unexpected result arising from the concomitant extrusion of the plasticized mixture of two incompatible thermoplastics. Plaintiffs ask this court to hold that Seckel's discovery of a new composition of matter of unique, unexpected, desirable properties—an internally fibrous strip—produced by mixing, plasticizing, and extruding cellulose acetate and cellulose acetate butyrate is patentable.

The steps in the patented process are: (a) Mixing two incompatible thermoplastic fiber-forming linear-polymeric compositions; (b) plasticizing the mixture in an extruding machine; and (c) extruding the mixture through a die, the result of which is a longitudinally fibrous strip. Steps (b) and (c) alone and combined are not patentable under the familiar standards set forth in *The Great Atlantic & Pacific Tea Company* v. *Supermarket Equipment Corp.*, 340 U. S. 147 (1950); *Cuno Engineering Corp.* v. *Automatic Devices Corp.*, 314 U. S. 84 (1941); this court's views concerning patentability are set forth in *Joseph Bancroft & Sons Co.* v. *Brewster Finishing Co.*, 113 F. Supp. 714

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[7] 35 U. S. C. A. §103.

[8] I.E., heated until melted.

(D. C. N. J. 1953), affirmed 210 F. 2d 677 (CA 3 1954) and *Avery* v. *Ever Ready Label Corp.*, 104 F. Supp. 913 (D. C. N. J. 1952).

Is the mixing described in (a) alone or combined with (b) and (c) to produce the strip sufficient to sustain the patent? The Goessling Patent No. 2,353,457, issued July 11, 1944, for "Synthetic Pearl Resin" discloses the principle of mixing two incompatible thermoplastic resins to produce a resin having an appearance similar to pearl; the pearl effect is achieved by mixing the molding powders of two clear plastics or of one clear plastic and one translucent plastic and heating them in an injection molding machine to produce a molded article. The Jacqué Patent No. 2,185,789, issued January 2, 1940, for "Thread and Fiber of Organic Thermoplastic Materials and Process of Producing the Same" discloses a process of producing threads from highly polymerized organic materials by forming a thin film of the material and stretching it in the direction of its length. The Malm Patent No. 2,223,376, issued December 3, 1940, for "Yarn" teaches that a fiber can be made from cellulose acetate butyrate. The Dreyfus Patent No. 2,050,286, issued August 11, 1936, for "Method of Making Synthetic Straw" teaches the use of cellulose acetate and cellulose acetate butyrate under heat and pressure to obtain a plurality of fibers. Such disclosures, especially Goessling's, that two incompatible polymeric materials could be mixed and injection molded to produce a unitary structure with the materials retaining their separate phases anticipated Seckel's mixture and result. Additionally, a publication entitled *Plastics Technology*, "Stretch Orientation of Polystyrene and Its Interesting Results," written by James Bailey, and contained on pages 225-231 of the May 1934 issue of *India Rubber World*, discloses that in a fiber-forming polymer which is extruded, the molecules will be aligned in a longitudinal direction.

Based upon such disclosures and aided by the expert testimony interpreting the prior art, the court concludes that it would have been obvious to a person having ordinary skill in the art that cellulose acetate and cellulose acetate butyrate were a fiber-forming polymer, which when extruded individually through a small orifice would form a longitudinal fiber; and it would have been obvious to such a person that the two materials were incompatible so that if they were mixed and extruded they would retain their separate natures even though coalescing into a unit.

During the trial, the plaintiffs introduced considerable evidence that the patented product can be sewn through, which apparently they believed was a feature tending to prove patentability. Plaintiffs, however, in their lengthy brief and proposed findings of fact and conclusions of law do not discuss that feature of their product. Moreover, in their brief they admit that feather boning, which preceded their product, can be sewn through. Although, "A patent will protect its holder in his monopoly over whatever use it is capable.", *Floridin Co.* v. *Attapulgus Clay Co.*, 125 F. 2d 669, 670, 671 (CA 3 1942), the court notes that nowhere in the patent is there a disclosure of the sewing feature.

Plaintiffs' brief refers to the patent in suit in glowing terms, such as, "unexpected and outstanding discovery"; "a synergistic effect if there ever was one"; "unexpected result * * * contrary to the teachings and experience of the plastics industry"; "a giant and radically different stride in the plastics art"; "the discovery of Seckel that the eleven year dogma of the entire plastics art had been wrong"; "in one stroke of experiment buried forever the eleven year misconception and ignorance of an entire industry"; "the hallmark of the greatest of inventions"; "a classic case of the discovery of a new composition"; "unexpected result in the light of these prior contrary teachings and beliefs"; "pushed back the borders of dark-

ness and advanced the frontiers of science"; "taught the art to follow him on a path in a direction 100% opposite to that chartered by the leading scientists of the industry"; and even suggesting an analogy between the Seckel invention and that of Charles Goodyear for vulcanizing rubber. These "findings" are interesting and if true might call for a finding of validity, but unfortunately they are not supported by evidence. Language such as this suggests a need for more semantic discipline.

Plaintiffs' brief further suggests that Section 103 of the 1952 Patent Code was intended to reduce or lower the standard of invention as set out in the decisions of our Supreme Court and other federal courts during the past twenty-five years. It is true that Judge Learned Hand's opinion in *Lyon* v. *Bausch Lomb Optical Co.*, 224 F. 2d 530 (CA 2 1955), sets forth by way of dictum that such was the intention of Congress. However, the Court of Appeals for the Third Circuit in 1953 said in *Stanley Works* v. *Rockwell Manufacturing Co.*, 203 F. 2d 846, 849:

> "On its face Section 103 is merely a codification of decisional patent law. The report of the Senate Committee on the Judiciary (Vol. 38, No. 8, Journal of the Patent Office Society of August 1952) leaves no doubt about this. In part that report states:
>
> 'Section 103, for the first time in our statute, provides a condition which exists in the law and has existed for more than 100 years, but only by reason of decisions of the court. An invention which has been made, and which is new in the sense that the same thing has not been made before, may still not be patentable if the difference between the new thing and what was known before is not considered sufficiently great to warrant a patent. That has been expressed in a large variety of ways in deci-

> sions of the courts and in writings. Section 103 states this requirement in the title. * * *.' ''

In applying the high standards of patentable invention set by our Supreme Court, our task is to draw the line between a small step forward and a giant stride. This process and product are useful, but certainly there has been no giant stride. I conclude, therefore, the patent claims involved here invalid for lack of invention.

As to defendants' request for attorneys' fees, 35 U. S. C. A. §285 provides that "The court in exceptional cases may award reasonable attorney fees to the prevailing party." The allowance of attorneys' fees is discretionary. *Randolph Laboratories* v. *Specialties Development Corp., et al*, 213 F. 2d 873 (CA 3 1954), cert denied sub nom. *Specialties Development Corp.* v. *Randolph Laboratories, Inc.* (1954); *Jacquard Knitting Machine Co., Inc.* v. *Ordnance Gauge Co., Inc., et al*, 213 F. 2d 503 (CA 3 1954). The court does not find plaintiffs guilty of any bad faith, nor is there any other "* * * equitable consideration of similar force which would make it greatly unjust for defendant[s] to take care of its [their] own counsel fees * * *." *Jacquard Knitting Machine Co., Inc.* v. *Ordnance Gauge Co., Inc., et al*, 213 F. 2d 503, 509 (CA 3, 1954).

The foregoing opinion shall constitute findings of fact and conclusions of law, as required by Rule 52.

An order may be submitted in conformity with the opinion herein expressed.

Judgment Appealed From

Civil Action No. 285—51

This cause having come on to be heard upon the pleadings and proofs and having been fully presented by the parties, upon full consideration thereof and pursuant to the opinion of this Court filed May 14, 1956, it is,

ORDERED, ADJUDGED AND DECREED:

1. That the Court has jurisdiction over the subject matter and all of the parties hereto.

2. That plaintiff Richard A. Fisch is the owner of, and plaintiff Anchor Plastics, Inc. is the exclusive licensee under, United States Letters Patent No. 2,531,234.

3. That claims 2 and 7 of United States Letters Patent No. 2,531,234, relied upon by the plaintiffs, is each invalid and void.

4. That the complaint herein be and hereby is dismissed.

5. That defendants' counterclaim for a declaratory judgment that each of claims 1, 2, 4, 5 and 7 of United States Letters Patent No. 2,531,234 is invalid and void, is hereby sustained.

6. That defendants having failed to press at the trial their counterclaim for unfair competition and having limited their proofs in this regard to a claim for a reasonable attorneys' fee, such counterclaim is hereby dismissed.

7. That plaintiffs have not been guilty of any bad faith or other inequitable act and, therefore, the defendants' request for an award of attorneys' fees is denied.

8. That the defendants recover from the plaintiffs their costs to be taxed by the Clerk of this Court.

O. E. MODARELLI
U. S. D. J.

Dated: Nov. 13, 1956